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A New Species of *Amygdalus* (Rosaceae) from Iran

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Abstract. *Amygdalus ghahremanii* Maroofi, Attar & Vafadar, a new shrubby species of the genus *Amygdalus* L. (Rosaceae) from Iran, is described and illustrated. This new species was collected from Kurdistan Province in western Iran. The closest relative to *A. ghahremanii* is *A. korshinskyi* (Hand.-Mazz.) Bornm., which also occurs as a more or less widespread species in western and northwestern Iran and is a sympatric relative. Morphological differences between *A. ghahremanii* and *A. korshinskyi* are found in the indumentum of young branches and petioles, length of pedicels, length of hypanthia, sepals and styles, as well as in the internal indumentum of the basal portion of the hypanthium and in the shape of drupes and stones.

Key words: *Amygdalus*, Iran, IUCN Red List, Kurdistan, Rosaceae.

The family Rosaceae with 29 genera and 243 species (Ghahreman & Attar, 1999) is one of the most significant and taxonomically problematic plant families in Iran, with 58 taxa considered to be endemic. Among these, *Amygdalus* L., a genus of deciduous trees and shrubs, has particular status because Iran appears to be the principal center for its species diversity. Approximately 40 to 45 species comprise the genus, which is distributed mainly in the Irano-Turanian region in southwestern and middle Asia as well as in the Mediterranean region. A few species are known to occur in eastern Asia (China and Mongolia) as well as into southeastern Europe (Browicz & Zohary, 1996). *Amygdalus* species are adapted to semi-arid environments, steppes, mountainous areas, and rocky or gravelly slopes. According to Flora Iranica (Browicz, 1969), *Amygdalus* is represented by 15 species and two hybrids in Iran. Based on the Flora of Iran (in Persian), within the Rosaceae (Khatamsaz, 1993) *Amygdalus* has 21 species and six hybrids. Species of *Amygdalus* are found in neighboring countries, especially in Turkey, Russia, central Asia, and the Middle East (Shishkin & Yuzepchuk, 1941; Browicz, 1972; Zohary, 1972). In this paper, *A. ghahremanii* Maroofi, Attar & Vafadar, a new shrubby species, is described and is assigned within *Amygdalus* subg. *Amygdalus* sect. *Amygdalus*.

Amygdalus ghahremanii Maroofi, Attar & Vafadar, sp. nov. TYPE: Iran. Kurdistan: ca. 34 km from Saqqez to Baneh, beginning of rd. of Nakarouz Mtn., 1500 m, 8 May 2007, *H. Maroofi*, *F. Attar & M. Vafadar 37325* (holotype, TUH). Figure 1.

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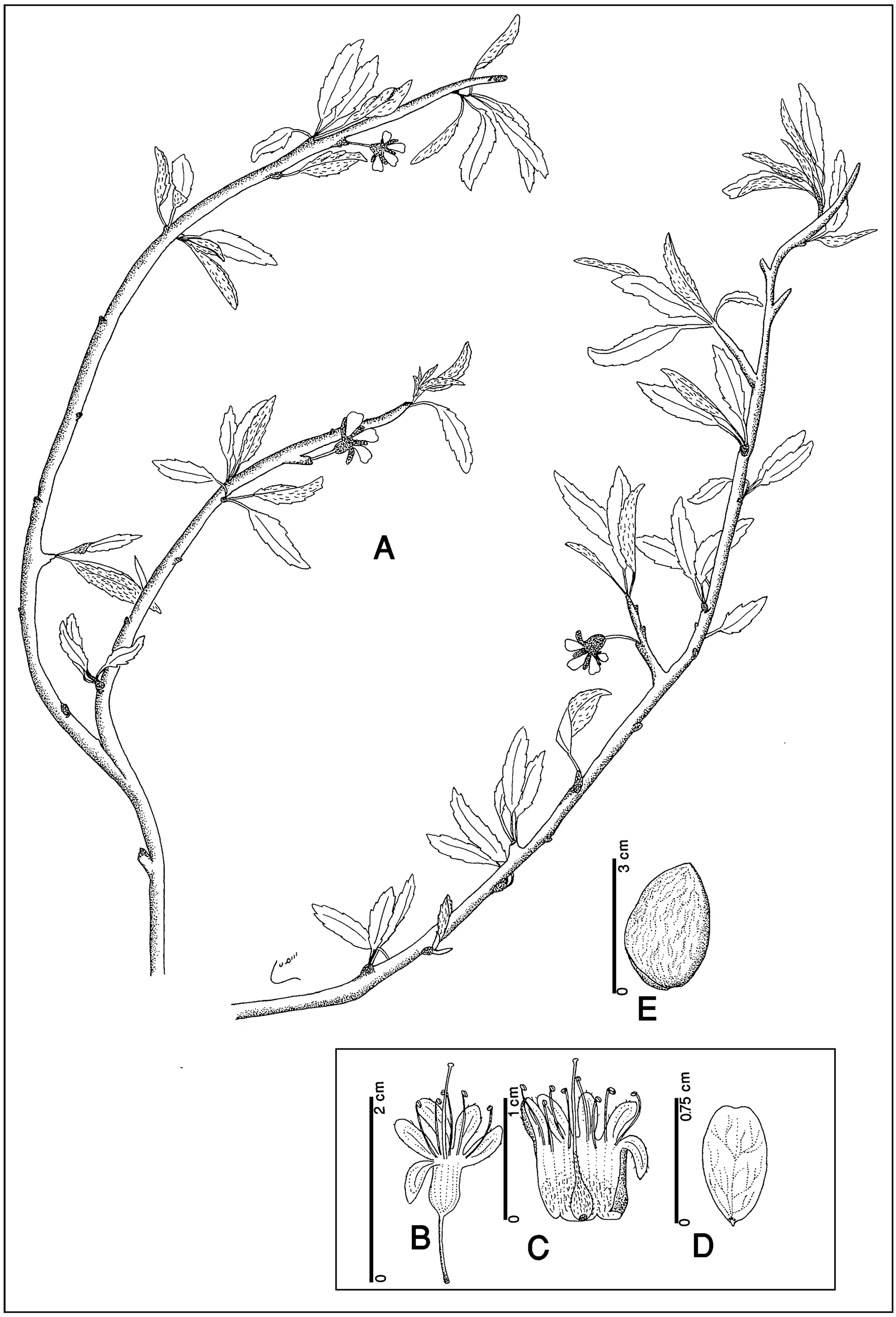


Figure 1. *Amygdalus ghahremanii* Maroofi, Attar & Vafadar. —A. Fertile habit. —B. Intact flower with external view of hypanthium. —C. Flower, with the hypanthium dissected to reveal the biseriate stamens and gynoecium. —D. Petal. —E. Drupe. A–E drawn from the holotype *H. Maroofi, F. Attar & M. Vafadar 37325* (TUH).

Haec species *Amygdalo korshinskyi* (Hand.-Mazz.) Bornm. afffinis, sed ab eo ramulis junioribus pubescentibus (nec glabris), petiolis usque ad 12 (nec 10) mm longis pubescentibus; pedicellis usque ad 10 (nec 3) mm longis, sepalis 7–8 (nec ca. 4) mm longis, hypanthio ca. 7 (nec 5) mm longo ad basem villoso, sepalorum cum hypanthio proportione ca. 1.07:1 (nec ca. 0.8:1), stylo usque ad 12 (nec 8) mm longo atque drupis ovoideis 33–35 × 22–23 (nec ca. 30 × 24) mm differt.

Table 1. Morphological differences between *Amygdalus korshinskyi* (Hand.-Mazz.) Bornm. and *A. ghahremanii* Maroofi, Attar & Vafadar.

	A. ghahremanii	*A. korshinskyi*
Young branch indumentum	pubescent	glabrous
Leaf length (mm)	30–45	25–40
Leaf width (mm)	8–13	10–15
Petiole length (mm)	10–12	8–10
Petiole indumentum	pubescent	glabrous
Pedicel length (mm)	9–10	to 3
Hypanthium length (mm)	7	5
Sepal color	red-brown	red-pink
Sepal length (mm)	7–8	4
Sepal length:hypanthium length ratio	1.07:1	0.8:1
Hypanthium internal indumentum	yellowish villous at base	yellowish orange pubescent throughout
Style length (mm)	11–12	8
Drupe shape	ovoid, compressed apically	broadly ovoid to elliptic, not compressed
Drupe length (mm)	33–35	to 30
Endocarp or stone shape	ovoid	indistinctly keeled

Shrubs, 4.5+ m tall, with strict to erect branches unarmed, with numerous brachyblasts; annual shoots brown, older shoots dark gray to brown; young branches pubescent, then glabrate. Leaves alternate or fasciculate, stipulate, with the blades adaxially glabrous, abaxially pubescent, narrowly ovate to narrowly elliptic, 30–45 × 8–13 mm, acute, marginally dentate-crenate to dentate-serrate, the teeth terminated with 1 dark brown gland, broadly cuneate at base; petioles 10–12 mm, pubescent. Flowers solitary on axillary branchlets; outer bracts 1.5 mm, triangular-cordate, acuminate, glabrous, dark brown, persistent, inner bracts 7 mm, oblong to obovate, acuminate, pubescent externally, lighter pale brown, brown at apex; pedicels 9–10 mm. Flower with the hypanthium red-brown, glabrous, campanulate, 7 mm, villous internally with yellowish indumentum at base; sepals 5, imbricate, oblong, lightly pubescent, red-brown, 7–8 mm, sepal length: hypanthium length ratio 1.07:1; corolla 32–34 mm diam., petals bright pink, oblong to obovate, 15–16 mm, emarginate at apex, with a brief claw; stamens 24 to 27, inserted and biseriate, filaments 4.5–7.5 mm, pink; ovary with the style 11–12 mm, pubescent in lower portion. Fruit a drupe, ovoid, velutinous pubescent, acute, 33–35 × 22–23 mm, compressed apically; stone or endocarp surface light brown, ovoid, foveolate with some small grooves only near the base and with 1 lateral groove, truncate or broadly cuneate at base, compressed.

Distribution. *Amygdalus ghahremanii* is collected from rocky areas at the beginning of the road to Nakarouz Mountain, which is located in Baneh in Kurdistan Province, Iran. This province represents the principal center of species diversification for *Amygdalus* in Iran.

IUCN Red List category. *Amygdalus ghahremanii* was collected from a small population consisting of ca. 20 shrubby individuals at the type location. Because the species has been collected from only one location and there have been no other collections since, *A. ghahremanii* is classified as Data Deficient (DD), according to the IUCN Red List criteria (2001).

Etymology. The epithet was chosen in honor of the late professor Ahmad Ghahreman (1938–2008). He is the founder of the TUH Herbarium, the author of the 26-volume illustrated Flora of Iran, and is considered the father of botany in Iran.

Discussion. *Amygdalus ghahremanii* has one unique feature among the 23 species of *Amygdalus* recognized in Iran (Khatamsaz, 1992; Attar et al., 2009). The new species possesses the longest pedicels (9–10 mm) for species of *Amygdalus* in Iran. It is notable that flowers of *Amygdalus* species are either sessile to subsessile or pedicel length may range from 3 to 7 mm. Based on characters including the vegetative form and shrub height, leaf shape, hypanthial shape, and endocarp or stone indumentum, *A. ghahremanii* is related to *A. korshinskyi* (Hand.-Mazz.) Bornm., and the new species should be placed in *Amygdalus* subg. *Amygdalus* sect. *Amygdalus*. However, other morphological characters, especially the pubescent young branches and petioles, the uniquely long pedicels, the longer hypanthia, sepals, and styles, the villous indumentum of the basal hypanthium, as well as the ovoid shape of drupes and stones, indicate considerable differences between these two related species (Table 1).

Paratypes. IRAN. **Kurdistan:** ca. 34 km from Saqqez to Baneh, beginning of rd. of Nakarouz Mtn., 1500 m, 10 May 2007, *H. Maroofi, F. Attar & M. Vafadar 37245* (TUH), 10 Aug. 2006, *F. Attar, H. Maroofi & A. Zamani 36356, 36359, 36360, 36362* (TUH).

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A New Combination for the Indian Progenitor of Sesame, *Sesamum indicum* (Pedaliaceae)

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Abstract. The new combination *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian (Pedaliaceae) is provided for the progenitor of sesame. Both lectotype and epitype for *S. malabaricum* Burm., the basionym of the new combination, are designated herein. A plate (van Rheede tot Draakestein, 1689: tab. 55) mentioned in the original protologue (Burman, 1769) is designated here as the lectotype for *S. indicum* L. subsp. *malabaricum* (Burm.) Bedigian. Previously published evidence about the relationship of *S. indicum* and *S. malabaricum* summarized here and shared morphological traits described here provide a foundation for the recognition of this taxon at the changed rank of subspecies.

Key words: Domestication, Lamiales, Pedaliaceae, sesame, *Sesamum*.

The genus *Sesamum* L. (Pedaliaceae) includes 20 species that are native to tropical and warm temperate Africa and Asia. They are distinguished by their annual habit; sticky indument; opposite or alternate, entire to digitately divided or compound leaves; showy, zygomorphic flowers that are solitary in leaf axils; obliquely campanulate corollas; four stamens; dorsifixed anthers; annular disc at the base of the ovary; 2-locular ovary becoming 4-locular due to a parietal radial false septum, each compartment containing many 1-seriate superposed ovules; and dry capsular fruits with numerous small seeds. *Sesamum indicum* L. is the lectotype species, designated by M. L. Green (1929), and this name was conserved over the simultaneously published name *S. orientale* L. (McNeill et al., 2006). The genus was investigated by Ihlenfeldt and Grabow-Seidensticker (1979), who imparted some descriptive information, recognizing four sections.

Identification of the progenitor of cultivated sesame. Ihlenfeldt and Grabow-Seidensticker (1979: 58) considered *Sesamum latifolium* J. B. Gillett as "very probably ...the wild ancestor of the cultivated sesame" and classified it in *Sesamum* L. sect. *Sesamum*. They also listed *S. mulayanum* N. C. Nair as a form they classified with *S. indicum* that "may still represent early stages of domestication."

However, subsequent evidence has not supported *Sesamum latifolium* as the crop's progenitor, although Ihlenfeldt (2004, 2010) has continued to regard it as such. Ihlenfeldt and Grabow-Seidensticker (1979) did not demonstrate *S. latifolium* as the wild progenitor with any experimental evidence, i.e., genetic crosses. Thus, this did not meet the best available diagnostic criterion of the progenitor of a domesticated plant where reciprocal crosses produce fertile hybrid products, indicating that both species belong in the primary gene pool (Harlan, 1992). According to the nomenclature on cultivated plants proposed by Harlan and de Wet (1971), the cultivated variant and wild variant in the same primary gene pool should be treated as two subspecies of a single species.

Attempts at interspecific hybridization of *Sesamum latifolium* and cultivated sesame yielded only a few shriveled seeds, far below the minimum level of fertility to indicate a progenitor-offspring relationship (Bedigian, 1984, 1988, 2003a, 2003b, 2010). A progenitor-offspring relationship is also contradicted by the discrepancy in chromosome numbers between *S. latifolium* ($2n = 32$: Ihlenfeldt, 2004: 313; Ihlenfeldt & Grabow-Seidensticker 1979: 58) and *S. indicum* ($2n = 26$: Morinaga et al., 1929; Sugiura, 1931, 1936; Nohara, 1934; Richharia & Persai, 1940; Raghavan & Krishnamurty, 1947; Ramanathan, 1955; Kobayashi, 1956; Sarkar et al., 1972; Mitra & Biswas, 1979; Kamala & Sasikala, 1981; Sikdar & Biswas, 1983; Mitra, 1985; Zhan et al., 1988; Bose & Biswas, 1994; He et al., 1994; Prabakaran, 1996a, 1996b), as well as a dissimilarity in lignan profiles (Bedigian, 1984, 1988; Bedigian et al., 1985; Kamal-Eldin, 1993, 2011).

Additional evidence indicates that the wild species *Sesamum malabaricum* Burm. is, in fact, the crop plant's progenitor (Bedigian, 1984, 1988, 2003a, 2003b, 2010, 2011; Bedigian et al., 1985, 1986; Bedigian & Harlan, 1986). Cultivated sesame and *S. malabaricum* share a similar diploid chromosome number, $2n = 26$ (John et al., 1950; Mitra & Biswas, 1983; Thangavelu, 1994; Hiremath & Patil, 1999; Kawase, 2000, 2003; Annapurna Kishore Kumar,

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2003; Annapurna Kishore Kumar & Hiremath, 2008). The definitive criterion of domestication, defined by the fertile hybrid products of reciprocal crosses, has been reiteratively demonstrated between the two taxa (Bedigian, 1984, 1988, 1998, 2000, 2003a, 2003b, 2010, 2011; Bedigian et al., 1985) and indicates that both species belong in the same primary gene pool. Hybrids of reciprocal crosses between the crop plant and wild *S. malabaricum* have been confirmed as fully fertile. Independently, Hiremath and Patil (1999), Kawase (2000, 2003), Bisht et al. (2004), Annapurna Kishore Kumar (2003), and Annapurna Kishore Kumar and Hiremath (2008) repeated Bedigian's crosses, and each team also found the offspring of these reciprocal crosses to be fertile. Some of these studies were prepared on material identified as *S. mulayanum*. Separately, Bedigian (1984, 1988, 2003a, 2003b), Kawase (2000), and Annapurna Kishore Kumar (2003) each concluded from side-by-side morphological specimen comparisons that *S. malabaricum* and *S. mulayanum* belong to a single species. Thus, Bedigian (2003a: 780) synonymized the name *S. mulayanum* under *S. malabaricum*.

Bhat et al. (1999), Kawase (2000), and Nanthakumar et al. (2000), using RAPD genetic markers, supported the close relationship of *Sesamum indicum* to *S. malabaricum*. More recent results from molecular phylogeny analyses, using the two chloroplast DNA regions known to be broadly informative in the Lamiales (*ndh*F and *trn*LF, Olmstead et al., 2001) and from plants determined by this author, confirm that *S. indicum* and *S. malabaricum* are very closely related: "The results show that *S. indicum* and *S. malabaricum* are virtually identical in their chloroplast DNA sequences. This doesn't mean that they are the same species, but it does mean that the specimens sampled share a very recent ancestry" (Olmstead, Aug. 2012, pers. comm.).

Thus, several lines of evidence indicate that *Sesamum malabaricum* is the wild progenitor of cultivated sesame, which necessitates a revised circumscription of *Sesamum* sect. *Sesamum*. *Sesamum latifolium* was previously included with *S. indicum* in *Sesamum* sect. *Sesamum* by Ihlenfeldt and Grabow-Seidensticker (1979: 58) and Ihlenfeldt (2004), while they treated *S. mulayanum* as a "form" of *S. indicum*, representing an early stage in the process of domestication, but failed to recognize *S. mulayanum* at the rank of "forma" within any formal nomenclature. Given the numerous differences between *S. latifolium* and *S. indicum* indicated above, *S. latifolium* should no longer be assigned to *Sesamum* sect. *Sesamum* (Bedigian, in prep.). The sesame crop's progenitor has a recognizably different morphology, some ecological differences, and a substantially separate ecological trajectory. Consequently, a new combination at the infraspecific level in *Sesamum* is needed to unite the crop plants and their wild progenitor in the same species, as predicated by the various lines of evidence noted above. A full description is presented here for this new subspecies; a corresponding description of cultivated sesame, interpreted as the autonymic subspecies of *S. indicum* below, was presented by Stapf (1906), Bruce (1953), and Mkamilo and Bedigian (2007: 153–158).

Sesamum L., Sp. Pl. 2: 634. 1753. TYPE: *Sesamum indicum* L., typ. cons.

Sesamum L. sect. **Sesamum**.

Included species (2). *Sesamum indicum* L., *Sesamum malabaricum* Burm.

Ihlenfeldt and Grabow-Seidensticker (1979: 58) described the corollas of the species of *Sesamum* sect. *Sesamum* as having the "lower lip of flower not prominent." Quite the opposite, the lower lip of these species usually extends ca. 1 cm beyond the rest of the campanulate corolla, and the lower lip's pigmentation in the crop's progenitor is an intense purple. A photograph of that striking flower appeared on the cover of *Descriptors for Sesame (*Sesamum *spp.)* (International Plant Genetic Resources Institute, 2004). Additional photographs of *S. indicum* can be found at <http://www.tropicos.org>.

According to the International Code of Nomenclature (McNeill et al., 2012), Article 39.1, the name *Sesamum orientale* var. *malabaricum* G. V. Narayana (John et al., 1950) was not validly published, lacking a Latin description.

1. Sesamum indicum L., Sp. Pl. 2: 634. 1753. TYPE: India. "Habitat in India" (lectotype, designated by Abedin in Nasir & Ali [1973: 4], LINN-802.3).

1a. Sesamum indicum L. subsp. **indicum.**

1b. Sesamum indicum L. subsp. **malabaricum** (Burm.) Bedigian, comb. et stat. nov. Basionym: *Sesamum malabaricum* Burm., Fl. Malabar. Ind.: 4. 1769. TYPE: tab. 55 in Rheede, Hort. Malab., Vol. 9, 1689: 107 (lectotype, designated here, tab. 55 in Rheede [1689]). EPITYPE: India. Kerala (Changanacherry), 23 July 1971, *C. A. Ninan 5* (epitype, designated here, K). Figures 1, 2.



Figure 1. The earliest known illustration of *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian appeared in Hortus Indicus Malabaricus, Vol. 9, by van Rheede tot Draakestein, 1689: 107, tab. 55.

Sesamum orientale L. var. *malabaricum* G. V. Narayana, nom. inval. [no Latin diagnosis.] John, Narayana & Seshadri, 1950: 47–50. TYPE: India. Hills of Malabar, s.d., s. coll. [sine typo, Groundnut Research Stn., Tindivanum, S. Arcot, Madras].

Sesamum mulayanum N. C. Nair, Bull. Bot. Surv. Ind. 5: 251. 1963. TYPE: India. Haryana [Punjab]: Mahendragarh Distr., Kanana (Dadri), 22 Oct. 1962, *N. C. Nair 25127A* (holotype, BSD; isotypes, BSD [4]). [Duplicates with nonstandard alphabetical notation, all annotated by Nair.]

Erect annual herb, 0.5–3 m high, with unpleasant, rank odor, often divaricately branched; stems and branches in their upper part quadrangular with furrowed sides, pubescent to glabrescent, rarely pilose, glandular. Leaves heteromorphic, opposite below, alternate above, lower surfaces densely glandular, thinly pubescent on the prominent nerves; lower leaves 2–17 × 0.7–5.5 cm, usually palmately 3-foliolate, 3-lobed or tripartite, in less-developed ones the blade undivided, ovate from a rounded or obtuse base, apex acute, obtuse or rounded, margin coarsely dentate to serrate; upper leaves 0.75–2.5 cm, with gradually shorter petioles, the blades obovate to oblong to lanceolate to linear from an acute base, entire, apex acute. Flowers solitary in the axils of upper leaves; pedicel erect, 2–5 mm, with 2 sessile yellow glands each in the axil of a bract. Calyx persistent, to 1 cm at anthesis, drying and shrinking to 4–7.5 mm in fruit, thickened and obconical, calyx segments oblong to lanceolate, acute or obtuse, pubescent; corolla 2.25–5.5 cm, pink or white, pubescent, usually with intensely deep purple pigmentation on the lower lip (Fig. 3), with 2 yellow extrafloral nectary glands 2–3 mm long at the base, with nectar guide and foveola in throat; filaments glabrous, arising at base of corolla, with a cushion of eglandular trichomes, 6–9 mm; anthers 3–3.5 mm, glabrous, with a thin black longitudinal stripe, connective prolonged and terminating in a globose gland; staminode minute or wanting; ovary slightly compressed, 4 mm, rounded at apex, pilose; style glabrous, white, 8–12 mm; stigmatic lamellae lanceolate, acute. Capsule erect, oblong, quadrangular, 4-grooved, rounded at base, acuminate into a beak at apex, capsule body excluding beak length 2–2.5 × 0.6 cm, woody, pubescent, pilose or bristly,



Figure 2. Epitype specimen for *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian, *C. A. Ninan 5* (K). Photograph provided by ©The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew. The author met the collector, C. A. Ninan, Head, Department of Botany, Kerala University, Kariyavattom, Trivandrum, India, in September 1979; the following day the author visited C. M. John at his plantation in Changancherry to document the location where Ninan's specimen had been collected.



Figure 3. Fertile plant of *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian, photographed by the author September 18, 1979, at Sinhagad, a hill fortress 30 km southwest of Pune, India. The hill is ca. 800 m, with the Sinhagad fortress ca. 1350 m above sea level. The corolla has a long, dark purple lip and yellow extrafloral nectary glands. Inset: Reticulations on the seed surface of *S. indicum* subsp. *malabaricum* photographed by the author using a Nikon (Tokyo) SMZ1000 microscope and a Nikon Coolpix 8800VR camera.

incompletely dehiscent, finally splitting to base; capsule beak 3–5 mm; seeds dark brown or black, broadly ovoid, 2–2.5 × 1.5 × 1 mm, faces conspicuously reticulately rugose (Fig. 3).

Although Burman (1769) provided no descriptions of his new species, he made direct reference to published descriptions and plates of van Rheede tot Draakestein (1689). Article 38.1 of the International Code of Nomenclature (McNeill et al., 2012) specifies that a name may be validated by reference to a previously and effectively published description or diagnosis, as was done by Burman. Thus this name is validly published here by J. Burman, the father, and not N. L. Burman, as sometimes cited. The van Rheede tot Draakestein figure (1689: 107, tab. 55) is associated with Burman's protologue and

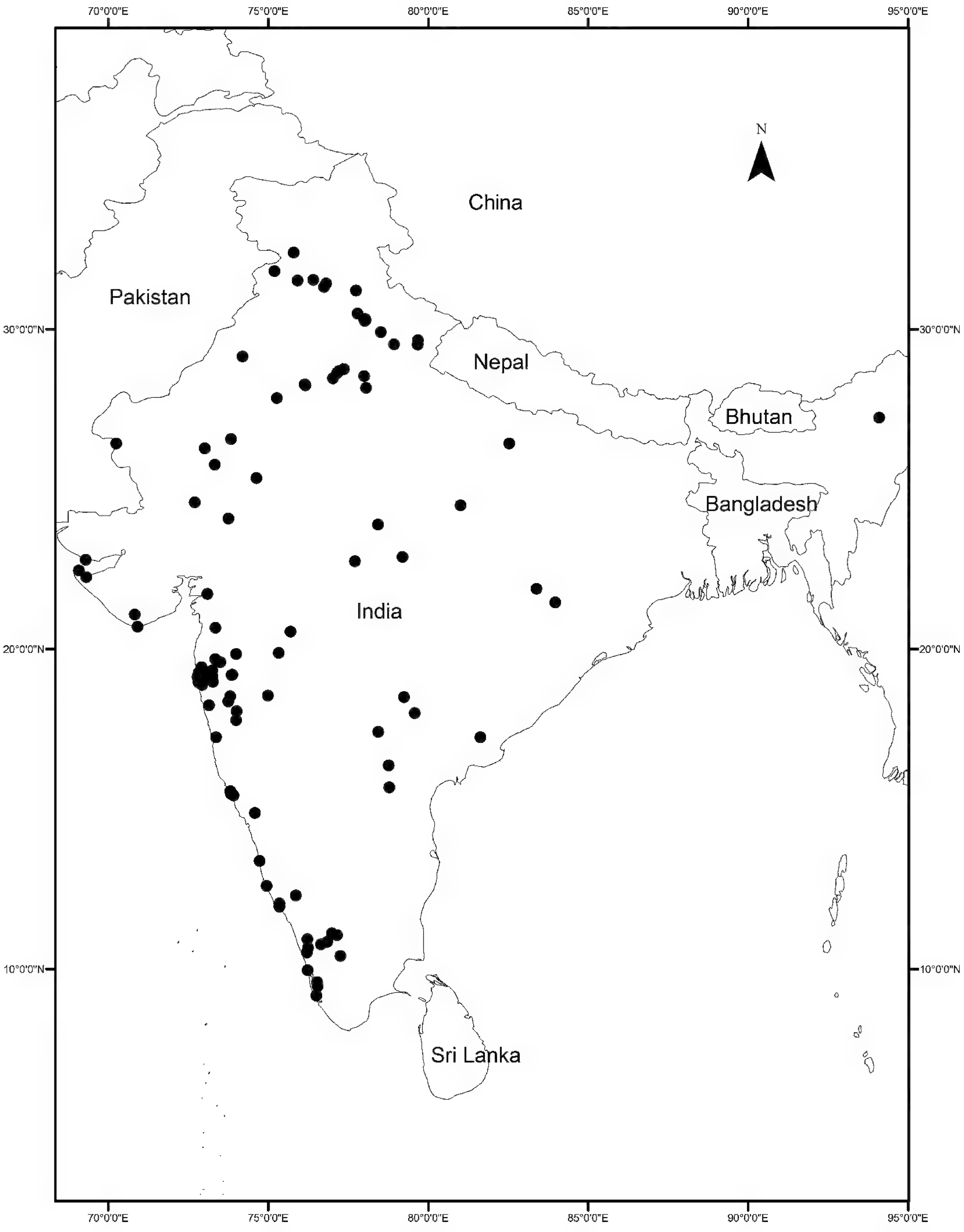


Figure 4. Map plot for all specimens of *Sesamum indicum* subsp. *malabaricum* available at herbaria in India (BLAT, BSD, BSI, CAL, DUH, MH, TBGT), for specimens at K, and as collected by the author (seeds at CEL, duplicates at U.S. Department of Agriculture, Beltsville, Maryland).

is selected here as the lectotype. The plate is closely correspondent to the plant collected by myself in 1979 (Fig. 3). Nicolson et al. (1988: 180) refer to *Car-elu*, citing van Rheede tot Draakestein (1689: 107, tab. 55): "probably a shortened form of *karuthellu* sometimes used instead of *ellu*; *karutha* means black (a reference to seed color)." Bedigian and Harlan (1986) discussed the widespread adoption of the word *ellu*, and its derivation from the Dravidian *eL*.

Distribution. *Sesamum indicum* subsp. *malabaricum* is documented from the Indian subcontinent, extending from northernmost Himachal Pradesh southward to Kerala (Fig. 4).

Habitat and ecology. *Sesamum indicum* subsp. *malabaricum* has been collected from plains and hilly forests at elevations to 1600 m. The subspecies has been observed in cultivated fields and forests. Populations can be weedy on roadsides. The taxon has been noted from mountain foothills and along railroad tracks. Van Rheede tot Draakestein (1689: 107) noted it as "loving sandy soil."

KEY TO THE SUBSPECIES OF *SESAMUM INDICUM* L.

1a. Seed color variable, white, ivory, beige, tan, mustard yellow, brick red, various shades of brown, gray, or black; seed surfaces smooth, granular, seldom transversely or reticulately rugose, not dormant; corolla 15–33 mm long; lower lip occasionally equal to, or more usually 2–10 mm longer than, other lobes; corolla coloration variable, from white, light pink, pale lavender to light purple, or with pale lavender lines, ranging in intensity from 1 to 8 on a scale of 1 to 10, coloration varies with cultivar, some with linear markings, some tinted only at lower margin of lower lip, with variable intensity and variable amount of surface area covered; capsule 1.5–5 cm long, bicarpellate and tetracarpellate, texture papery to woody (variable); living plant color in shades of green, extending from yellow-green, fern green, shamrock green, emerald green, forest green, jade green, sea green, dark green with purplish hue; extrafloral nectary glands 1–1.2 mm; plant generally 30–110 cm high, branching variable, cultivar-dependent, from single-stemmed to profusely branching; lower leaves varying by cultivar, ranging from occasionally divided, tripartite, with toothed margins, some with leafy outgrowths at base of leaves above petiole; many cultivars with lanceolate or simple ovate leaves . . . . . *S. indicum* subsp. *indicum*

1b. Seed color dark brown or black; seed surface conspicuously reticulate and rugose, markedly dormant; seeds 2–2.5 mm long, with distinct sharp edges, sides broad, transversely or reticulately rugose; corolla 22.5–55 mm long; lower lip 10–15 mm longer than other lobes, dark purple, with intensity of color ranking 10 on a scale of 1 to 10, pigmentation occupying entire lower lip; capsule 2–2.5 cm long, bicarpellate, texture woody; living plant color dark green, often with purplish hue; extrafloral nectary glands 2–3 mm; plant often reaching 200 cm high, typically branching profusely; lower leaves divided, undivided, and serrate in less-developed leaves, without leafy outgrowths at base of leaves above petiole . . . . . *S. indicum* subsp. *malabaricum*

Selected specimens examined. INDIA. **Andhra Pradesh:** Jct. near Mananur [Pratap Rudra Kot], *L. J. G. van der Maesen 3234* (K); Karimnagar Distr., Aklaspur loc., *G. V. Subbarao 25601* (MH); Hyderabad, Jubilee Hills, *L. J. G. van der Maesen 4957* (K, WAG); Kurnool Distr., Chelama, Nallamalais, *J. Ellis 22027* (MH); Nandyal-Kurnoof Distr., Nallamalal-Nandyal, Nallamalai loc., 26 Sep. 1951, *N. Krishnaswamy s.n.* (MH-94223); Polavarum (W. Godavaru), *S. K. Wagh 6921* (BLAT); Warangal, 29 Sep. 1974, *s. coll.* (K). **Assam:** Lakhimpur, *C. L. Malhotra 23566* (BSD). **Delhi:** Delhi Ridge, *D. Bedigian 105* (MO); Delhi Ridge, adj. to Univ. of Delhi, *R. J. Rodin 8025* (K). **Diu:** Gogale, *R. S. Rao 102770* (BSI, CAL). **Goa:** Barazan, *N. P. Singh 125068* (BSI); Caranzal, *N. P. Singh 124952* (BSI); Valpai, *G. H. Khirti 124098* (BSI). **Gujarat:** Broach, N railway track, *G. L. Shah 6244* (BLAT); Dwarka along railway line, *H. Santapau 14676* (BLAT); Gir Forest, *K. T. B. Hodd 37* (K); Subir, Dang Forest, *R. Asrava 3192* (BLAT). **Haryana:** Gurgaon, 25 Oct. 1962 (BSD-25261). **Himachal Pradesh:** Bilaspur, Mondi Rd., *Pritam Lal 63204* (BSD); Dhundla, *B. P. Uniyal 61125* (BSD); Kangoo to Dehar, *S. K. Murti & R. Prasad 62215* (BSD); Mahasu Distr., Rohru, *N. C. Nair 36185* (BSD). **Karnataka:** Siddapur, *S. Singh 44597* (BSD); Sullia, S Kanara, *C. A. Baker 2147* (MH). **Kerala:** Cannanore Distr., [Kannur], Kumbla loc., *R. Ansari 64917* (CAL); Changanacherry, *C. A. Ninan 5* (K); Palakkad [Malabar] Distr., Walayar loc., *S. R. Raju & Ratnavalu 18635* (MH); Trichur Distr., near Wadakkancherry, *K. Ramamurty 48451* (MH). **Madhya Pradesh:** Hoshangabad Distr., Churna–Dharin Rd., *J. Joseph 11220* (MH); Tikamgarh, Singhpura loc., *D. M. Verma 30666* (CAL). **Maharashtra:** Aarey Milk Colony, Goregaon, near central dairy, *S. C. Tavakari 39* (BLAT); Bassein, Thana Distr., *H. Santapau 22625* (BLAT); Borivali Nat. Park, *P. S. Herbert 1760* (BLAT); Dhaula Forest Malki, near Vangani Badlapur range, *K. V. Millore 115353* (BSI, CAL); Madh Island, *C. Saldanha 1348*, *1355*, *1357* (BLAT); Nasik Distr., Sawarna, on way to Gujarat border, *J. Cherian 111476* (BSI); Pune Distr., below Maluste, on way to Mangaon–Amgavne–Mulshi taluk, *B. V. Reddi 101113* (BSI). **Orissa:** Sambalpur Distr., Chamunda, *H. F. Mooney 2309* (K). **Punjab:** Gagret, Hoshiarpur, *O. P. Misra 44637* (BSD); Gurdaspur, Batala, *U. C. Bhattacharyya 37599* (BSD): Gurdaspur, Dhar, *U. C. Bhattacharyya 39448* (BSD); Hoshiarpur, *P. Daniel 67549* (BSD); Jalandhar, Div Rd., *R. S. Rao 102490* (BSI, CAL). **Rajasthan:** Badnor, Bhilwara, BSI Jodhpur, *A. N. Singh 6481* (CAL); Jodhpur Distr., Seriganga compound I, Jodhpur, *B. V. Shetty 149* (CAL); Lohargal, *N. C. Nair 1033* (BSD); Massoria, Jodhpur Distr., *P. J. Parmar 4857* (BSI); Mt. Abu., Abu Rd., 4th mile, *R. S. Rao 66694* (BSI); Udaipur Distr., Parshad, Sisa forest, 27 Sep. 1962 (BSI-82194). **Tamil Nadu:** Boluvampatti-Ichipatti Forest Res., on way from Walayar from Konamalai, *C. P. Sreemadhavan 745* (MH); Coimbatore Distr., Ichipatti Forest Res., *V. Narayanaswamy 78189* (MH); Dindigul Distr., Udumelpet, Palni Hills, Amaravathi Dam, *K. M. Matthew 47189* (K); Travancore Distr., Kottayam loc., *C. M. John & G. V. Narayana s.n.* (MH-94220). **Uttar Pradesh:** Akbarpur, *Y. K. Sarin 8844* (BSD); Batia Chaur, Bijrani, Corbett Nat. Park, *B. C. Pant 72251* (BSD); Lakhaoti, *N. P. Singh 25422* (BSD); Pahasu, *N. P. Singh 31933* (BSD). **Uttarakhand:** Dak Pathar, next to rest house, *J. P. Sharma 77806* (BSD); Dehra Dun on way to Gorja, Gori Valley, *C. L. Malhotra & B. P. N. Balodi 77724* (BSD); Dehra Dun, Ajabpur, *N. C. Nair 25373* (BSD); Dehra Dun, Bindal, *C. R. Babu 33460, 33460a* (BSD); Dehra Dun, Bindal Rao loc., *T. A. Rao 974* (BSD); Dehra Dun, Nara, FRH loc., *J. N. Vohra & P. Daniel 54575* (BSD); Dehra Dun, Niranjanpur, *N. P. Singh 27475*

(BSD); Dina Pani, *J. N. Vohra 57916* (BSD); Kumaon, Chinpata, *C. M. Arora 49986* (BSD).

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Two New Species of *Coussapoa* (Urticaceae, Cecropieae)

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Abstract. Two new species, *Coussapoa dariensensis* C. C. Berg and *C. peruviana* C. C. Berg, are described and illustrated from Panama and Peru, respectively, for the Urticaceae, tribe Cecropieae.

Resumen. Se describen e ilustran dos especies nuevas de Urticaceae, tribu Cecropieae, *Coussapoa dariensensis* C. C. Berg y *C. peruviana* C. C. Berg, de Panamá y Perú respectivamente.

Key words: Cecropieae, *Coussapoa*, IUCN Red List, Neotropics, Panama, Peru, Urticaceae.

The Neotropical genus *Coussapoa* Aubl. is identified by its mostly hemi-epiphytic habit and dioecious inflorescences, and comprises ca. 50 species. It is mostly distributed in lowland rainforests to premontane forests from central Mexico (Jalisco and Veracruz) south through Central America to southeastern Brazil, and it is absent in the West Indies. Many of these species are noted to have small ranges of distribution, which is an indication that additional species remain to be discovered (Berg et al., 1990; Berg & Franco Rosselli, 1993). The genus is distinguished by the small staminate flowers containing one, two, or three stamens. In the 2- and 3-staminate flowers the stamens are fused, forming a stalk with, respectively, four or six (occasionally five) thecae at the apex. The number of stamens shown is constant between species, such as the single stamen in staminate flowers noted for *C. ovalifolia* Trécul. The current taxonomic study also includes a collection from Panama with glabrous perianths, which initially after superficial examination of the vegetative parts was regarded to belong to *C. ovalifolia*. In spite of the absence of material with staminate flowers, this material is to be regarded as a new species, mainly based on differences of the indumentum of the vegetative parts and the distinctly shorter peduncle of the pistillate inflorescence. The publication of these findings allows the publication of yet another discovery, a new Amazonian *Coussapoa* species, showing affinities to the Amazonian *C. scabra* Akkermans & C. C. Berg.

New Species in *Coussapoa*

1. Coussapoa darienensis C. C. Berg, sp. nov. TYPE: Panama. Darién: S slope of cerro Tacarcuna, trail from Río Pucuro base camp to westernmost peak, 1300 m, 30 Jan. 1975 (♀ fl.), *A. Gentry & S. Mori 14011* (holotype, MO; isotype, U). Figure 1.

Haec species *Coussapoae ovalifoliae* Trécul similis, sed ab ea ramulis foliosis stipulorum cicatricibus solum subhirsutis ceterum glabris et inflorescentiae pistillatae pedunculo breviore 0.8–1.5 cm (vs. 1–7 cm) longo differt.

Tree to 10 m tall. Leafy twigs 5–8 mm thick; glabrous but white subhirsute on the scars of the stipules (and the axillary buds white puberulous). Leaf lamina coriaceous, elliptic to subovate (to oblong), 10–19 × 5–12 cm; apex shortly acuminate; base subcuneate to rounded; upper surface glabrous; lower surface sparsely white appressed puberulous to strigillose on the main veins; lateral veins in 10 to 12 pairs, the basal pair 1/5 to 1/3 the length of the lamina, faintly branched; intercostal venation almost plane beneath; petiole 4–7 cm, 2–3 mm thick, appressed white puberulous; the epidermis flaking off; stipules 2.5–4 cm, white sericeous, caducous. Staminate inflorescences not seen. Pistillate inflorescences branched (or unbranched); common inflorescence peduncle 0.8–1.5 cm, 1.5–2 mm thick, sparsely puberulous; heads two to six, 3–5 mm diam.; perianth ca. 1 mm high, glabrous. Interfloral bracts absent.

[1] Cornelis Christaan 'Kees' Berg (1934–2012), fondly remembered as 'Doctor Cigarro.' A tribute by van Welzen et al. was published in Blumea 57: 199–206 (2013).

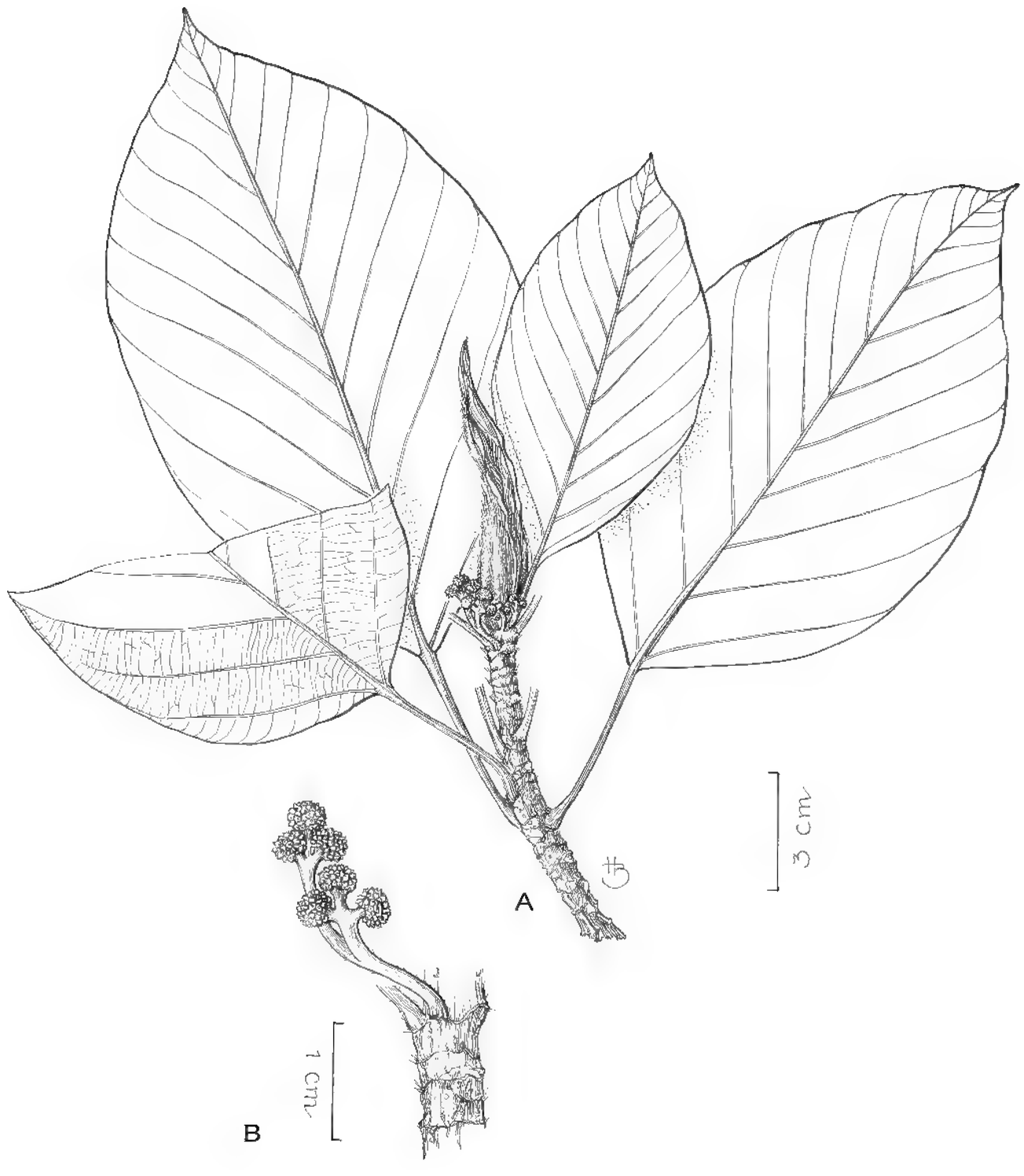


Figure 1. *Coussapoa darienensis* C. C. Berg. —A. Leaf twig with pistillate inflorescences. —B. Close-up of branched pistillate inflorescence, with six heads evident. From the holotype *A. Gentry & S. Mori 14011* (MO). Illustrated by H. Berg.

Distribution. *Coussapoa darienensis* is known only from the type locality, a premontane wet forest at 1300 m in the province of Darién, Panama.

IUCN Red List category. Since the new species is known only from a unicate collection, the conservation status of *Coussapoa darienensis* can only be assessed as Data Deficient or DD, utilizing the categories and criteria of the IUCN Red List (IUCN, 2001).

Discussion. At first sight the new species shows strong similarities to the Amazonian species *Coussapoa ovalifolia* and was already noted as such by Berg et al. (1990: 84). However, *C. darienensis* differs from this species in the short pistillate inflorescences and the mostly glabrous leafy twigs. This indumentum consists only of hairs of similar length and is confined to the scars of the stipules and the distinctly shorter peduncle of the pistillate inflorescence. One may wonder about the number of stamens of this new species.

2. Coussapoa peruviana C. C. Berg, sp. nov. TYPE: Peru. Junín: San Ramón–La Merced, Est. Exp. La Génova, 11°05′S 75°21′W, 1100 m, 13 Nov. 1998 (♀ fl.), *A. Daza & T. D. Pennington 16370* (holotype, K; isotypes, MOL [2]). Figure 2.

Haec species *Coussapoae scabrae* Akkermans & C. C. Berg similis, sed ab ea laminis foliaribus adaxialiter scabridulis majoribus (23–25 × 11–13 cm vs. 4–10 × 2.5–7 cm), stipulis longioribus (2.5–4 cm vs. 0.5–0.7 cm), petiolis longioribus (4–7 cm vs. 1–3 cm) et capitulis pistillatis majoribus (6–9[10] mm vs. 2–4 mm in diam.) differt.

Multistemmed tree. Leafy twigs 3–5 mm thick, whitish puberulous. Leaf lamina coriaceous, elliptic, 23–25 × 11–13 cm; apex shortly acuminate; base rounded to emarginate; margin undulate; upper surface puberulous to subhispidulous, scabridulous; lower surface whitish puberulous on the veins; lateral veins in 12 to 14 pairs, almost straight, reaching the margin into a faint marginal vein, the basal pairs 1/6 to 1/4 the length of the lamina, branched, tertiary venation scalariform; petiole 4–7 cm, ca. 2.5 mm thick, whitish puberulous; stipules 2.5–4 cm, yellowish sericeous, caducous. Staminate inflorescences not seen. Pistillate inflorescences unbranched or poorly and shortly branched, heads 1 or 2, if 1 head then ca. 10 mm diam., if 2 heads, then ± fused and each 6–9 mm diam.; common inflorescence

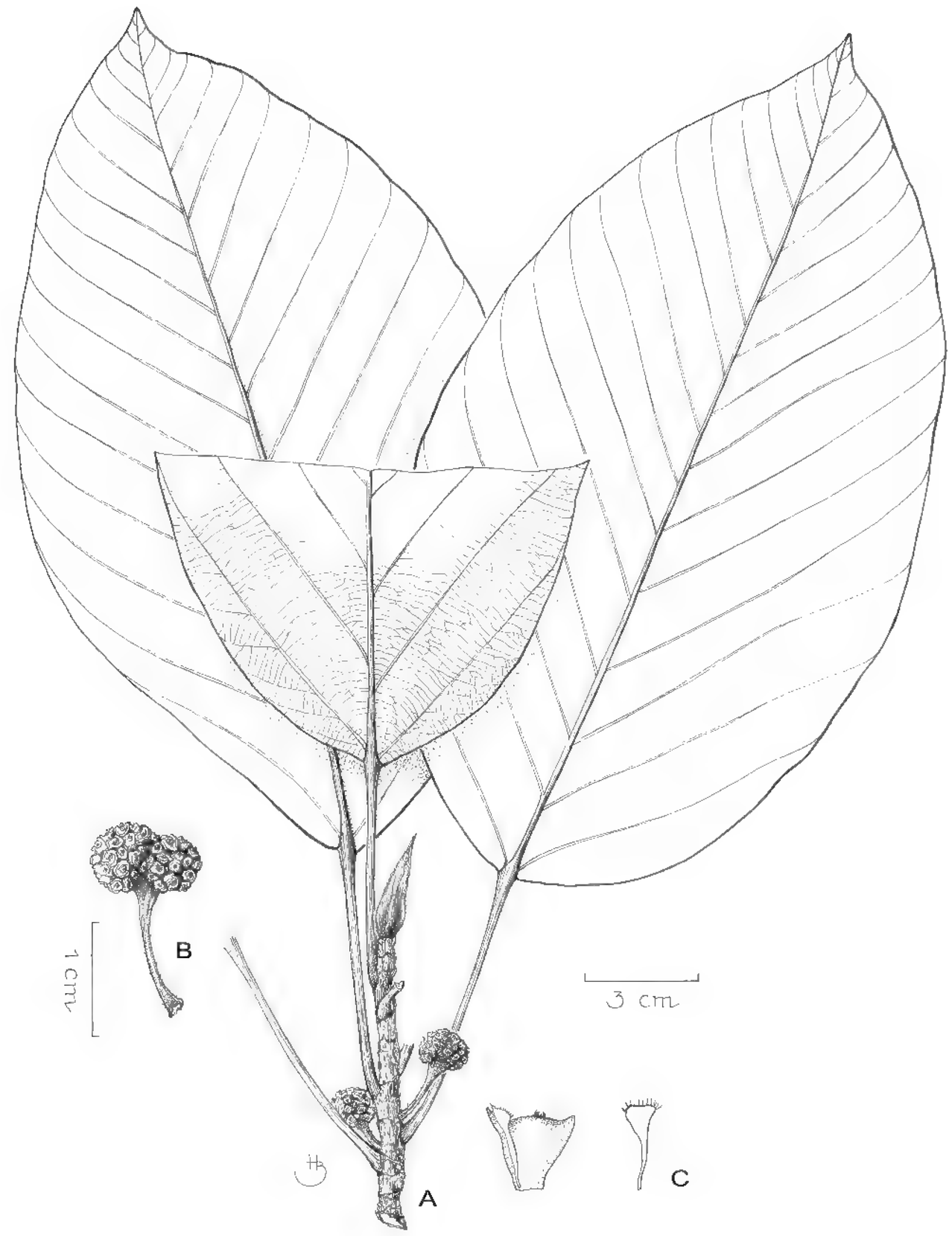


Figure 2. *Coussapoa peruviana* C. C. Berg. —A. Leaf twig with pistillate inflorescences. —B. Close-up of shortly branched pistillate inflorescence with two heads. —C. Pistillate flower subtended by an interfloral bract (left) and dissected interfloral bract (right). From the holotype *A. Daza & T. D. Pennington 16370* (K). Illustrated by H. Berg.

peduncle ca. 1.5 cm, white puberulous; perianth ca. 3 mm high, glabrous; interfloral bracts spathulate to subpeltate, slightly longer than the perianth, at the apex distinctly hairy.

Distribution. *Coussapoa peruviana* is known only from the type locality, growing as coffee shade in wet secondary forest at 1100 m, in the department of Junín, Peru.

IUCN Red List category. Since the new species is known only from a unicate collection, the conservation status of *Coussapoa peruviana* can only be assessed as Data Deficient or DD (IUCN, 2001).

Discussion. The new species shows similarities to *Coussapoa scabra*, which is only known by a single collection from Rondônia, Brazil. *Coussapoa peruviana* is distinguished by the scabridulous upper surface of the lamina. It clearly differs in the larger lamina (23–25 × 11–13 cm vs. 4–10 × 2.5–7 cm), the lateral veins almost straight reaching the margin to a faint marginal vein, the basal pair branched (vs. lateral veins straight to curved and conspicuously brochidodromous, the basal pair unbranched), the longer petioles (4–7 cm vs. 1–3 cm), the longer stipules (2.5–4 cm vs. 0.5–0.7 cm), the heads of the pistillate inflorescences larger (6–9[10] mm diam. vs. 2–4 mm diam.), and the interfloral bracts more distinctly hairy at their apices. Although these differences are mainly quantitative ones, recognition at the species level appears to be justified.

Acknowledgments. Hendrieke Berg (Norway) prepared the illustrations and is thanked for her assistance. Aniseto Daza (MOL) and Asunción Cano (USM) are also thanked for their help in locating material in their respective institutions. Comments from Servando Carvajal, Sergio Romaniuc Neto, and an anonymous reviewer on an earlier version of this manuscript are much appreciated; Victoria Hollowell's skillful editing greatly improved the manuscript.

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Paradrymonia peltatifolia (Gesneriaceae), a Recently Discovered Species from Panama

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Abstract. A recently discovered species is described from the Cobre mine site managed by Minera Panamá S.A. in Colón Province (Donoso District) in central Panama near the Caribbean coast. The new species, *Paradrymonia peltatifolia* J. L. Clark & M. M. Mora (Gesneriaceae, Episcieae), is easily distinguished from congeners by the presence of peltate leaf blades, which is a vegetative characteristic that is rare in the Gesneriaceae.

Resumen. Se describe una especie recientemente descubierta en la concesión Cobre Panamá manejada por la Minera Panamá S.A. en la provincia de Colón (distrito de Donoso) en el centro de Panamá cerca de la costa Caribe. La nueva especie, *Paradrymonia peltatifolia* J. L. Clark & M. M. Mora (Gesneriaceae, Episcieae), se distingue fácilmente de congéneres por la presencia de láminas peltadas, la cual es una característica vegetativa rara en las Gesneriáceas.

Key words: Gesneriaceae, IUCN Red List, Panama, *Paradrymonia*.

Ongoing efforts to document and monitor plant biodiversity in the Colón Province of Panama have resulted in the discovery of numerous new species. These efforts have been promoted through collaborations between Minera Panamá S.A. (MPSA) and the Missouri Botanical Garden and are aimed at mitigating impacts of a large copper mining concession. Here we describe a species that was discovered as a result of this collaboration. The new species, *Paradrymonia peltatifolia* J. L. Clark & M. M. Mora, is a terrestrial herb in the flowering plant family Gesneriaceae. The current circumscription of *Paradrymonia* Hanst. includes 38 species (Mora et al., 2012) and is the main focus of a Ph.D. dissertation (M. Mora, in prep.).

Paradrymonia peltatifolia J. L. Clark & M. M. Mora, sp. nov. TYPE: Panama. Colón: Distr. Donoso, helipad ZP-P9, 8°51′5″N, 80°40′19″W, 391 m, 20 July 2011 (fl.), *J. L. Clark & L. Martinez 12550* (holotype, US; isotypes, E, K, MO, NY, PMA, SCZ, SEL, UNA). Figure 1.

Diagnosis. Differs from all congeners by the presence of peltate leaf blades.

Terrestrial herb with erect to creeping stems; stems subwoody, subquadrate, sulcate, elongate with shoots to 30 cm long, each shoot with leaves apically clustered, light tan to rose-colored, hirsute; internodes longer than broad, 3–6.5 cm long near base, more clustered at apex; adventitious roots present, pinkish. Leaves opposite, unequal in a pair, the larger leaf in a pair with petioles (5–)13–40 cm, cross-section U-shaped, wine-red, densely hirsute; the blade (9–)16–21 × 7–16 cm, peltate with petiole attached 2–5 cm above margin of the leaf blade, ovate to orbiculate with dentate and ciliate margins, apex long-acuminate, base rounded, dark green and glabrescent to puberulous above, light green or purplish and hirsute along veins below; the lateral pairs of veins 5 or 6, departing midvein at a 50°–60° angle, tertiary veins distinct, reticulate; the smaller leaf strongly reduced, to 1 cm long, ovate to lanceolate, with serrate margins. Inflorescence a reduced pair-flowered cyme with 2 to 4 flowers that appear in axillary clusters, the prophylls oblong with ciliate margins, less than 10 × 1 mm, reddish green; the pedicels 1–4 cm long, rose-colored, hirsute. Flowers with calyx lobes subequal, 1.5–2 × 0.5–1.1 cm, ovate to lanceolate, hirsute, pale green to rose, serrate; corolla posture oblique relative to the calyx, ca. 3.5–4.5 cm long, trumpet-shaped, spurred at base for 5 mm, white to white suffused with pink, red streaks present in throat, sparsely sericeous, inside throat covered with glandular trichomes on upper surface, lobes 5, entire, subequal, ca. 10 × 10 mm, glabrous within; androecium with 4 stamens, included, didynamous, the filaments adnate for ca. 3 mm to the base of corolla tube, to 3 cm, white, glabrous, each anther apically coherent to its homologous pair, each anther 2 × 1 mm, the thecae dehiscent by longitudinal slits; gynoecium with the ovary ovoid, 4–4.5 mm, densely sericeous with long reddish trichomes, style ca. 2.1 cm, with sparsely distributed pubescence, stigma capitate, disc of a single bilobed gland on dorsal surface, ca. 2.3 mm long,

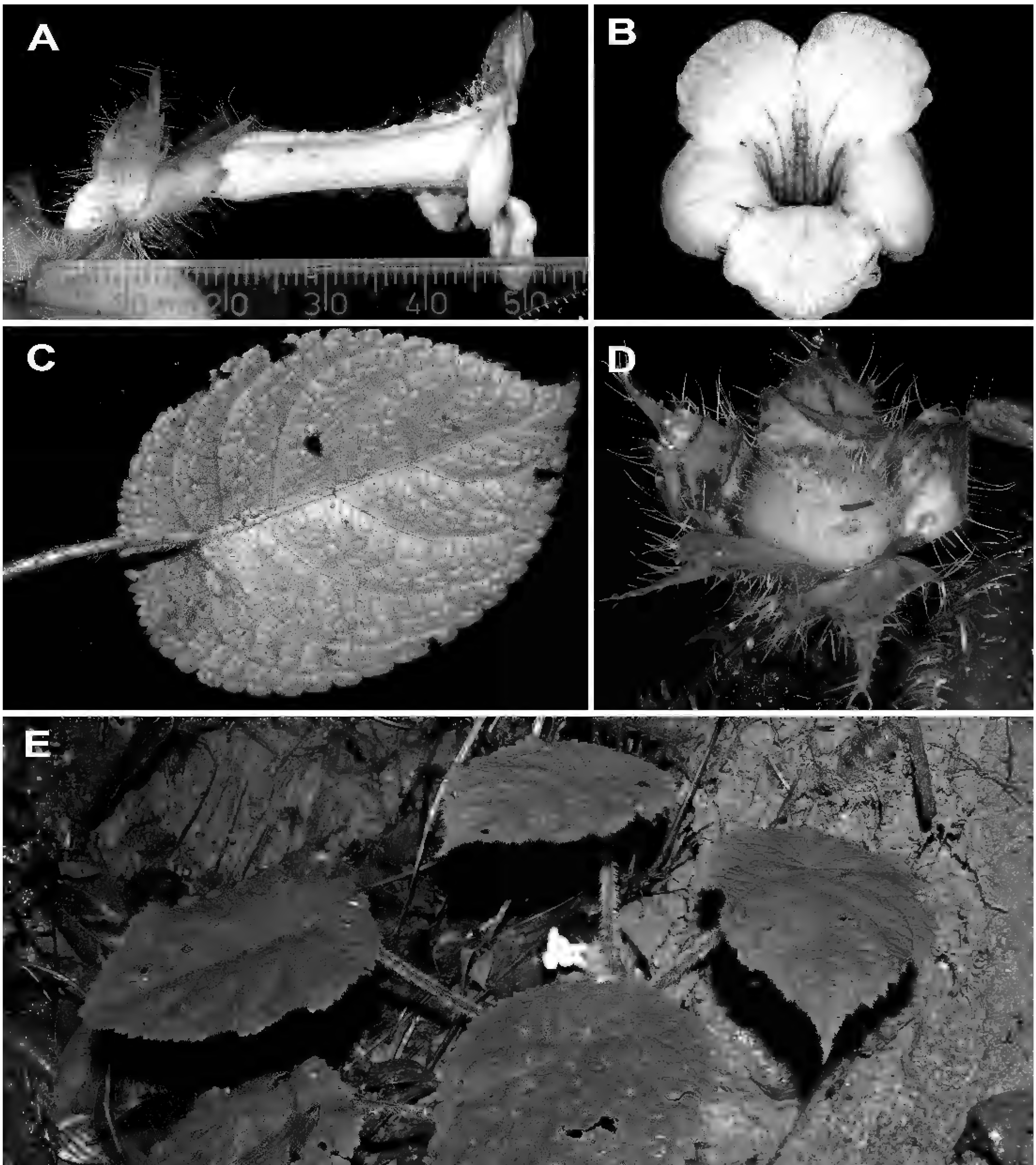


Figure 1. *Paradrymonia peltatifolia* J. L. Clark & M. M. Mora. —A. Lateral view of flower. —B. Front view of corolla. —C. Abaxial leaf surface showing peltate blade. —D. Immature fruit. —E. Habit showing clusters of leaves with peltate blades. Images of field collections in A, B, and E are from *J. L. Clark & L. Martinez 12550* (holotype, US), C from *J. L. Clark & L. Martinez 12578* (US), and D from *J. L. Clark & J. De Gracia 12450* (US).

entire, glabrous. Fruit a greenish yellow, bivalved, semi-fleshy (not succulent) capsule appearing laterally compressed; seed fusiform, striate, black, 5 × 3 mm, embedded in a fleshy funicle.

Distribution and habitat. *Paradrymonia peltatifolia* is endemic to Panama and is known only from the type locality in Colón Province. The lowland vegetation (i.e., below 500 m) of the Caribbean slope

where *P. peltatifolia* thrives is classified as Tropical Wet Forest (Holdridge, 1978).

IUCN Red List category. The only known populations of *Paradrymonia peltatifolia* are located inside a region that will be developed for a copper mine by MPSA. Population sizes of 10 to 15 individuals clustered along muddy streams were observed by the first author in two different localities. Six days of fieldwork during the summer of 2011 resulted in documenting one population near MPSA's Colina camp and a second population near helipad ZP-P9 (*J. L. Clark & L. Martinez 12578*). There are no known populations outside the copper mine concession, and therefore significant efforts are being implemented by MPSA to cultivate and transplant *P. peltatifolia*. These conservation efforts are ongoing for *P. peltatifolia* and other species as a way to mitigate the impacts to biodiversity when the mine is implemented. According to the IUCN Red List criteria (IUCN, 2001) for limited geographic range (B2a, less than 10 km^2 and known to exist at only a single location) and considering the uncertain future of the region, *P. peltatifolia* should be listed in the category CR (Critically Endangered).

Phenology. *Paradrymonia peltatifolia* has been collected in flower in March and July and in fruit in July.

Etymology. The specific epithet is derived from the Latin *pelta*, meaning shield; it refers to the petiole attachment near the center of the blade (Fig. 1C) instead of the more common attachment near the margin. A peltate leaf attachment is often associated with orbicular blades that appear shield-shaped.

Discussion. *Paradrymonia peltatifolia* is distinguished from its congeners by the presence of peltate leaves, in contrast to the more ubiquitous character state of blades that are attached at their basal margin to the petiole. *Paradrymonia peltatifolia* is the only known species of *Paradrymonia* with peltate leaves. This unusual vegetative character is uncommon in the New World members of Gesneriaceae. It is also known to occur in *Drymonia peltata* (Oliv.) H. E. Moore, which is an endemic species of the very humid forests of the central Pacific slopes of Costa Rica. Another New World gesneriad, endemic to Colombia and with seemingly peltate leaves, is *Nautilocalyx peltatus* (C. V. Morton) Wiehler. Morton (1945) noted in the description that the petiole is attached 3–7 mm above the margin of the leaf blade. However, the holotype and isotypes (*R. D. Metcalf & J. Cuatrecasas 30098*) of *N. peltatus* do not appear to have peltate leaves, despite the specific epithet and details provided in the description by Morton. Other species with peltate leaves include *Sinningia tuberosa* (Mart.) H. E. Moore from Brazil, *Metapetrocosmea peltata* (Merr. & Chun) W. T. Wang from China, and *Cyrtandra peltata* Jack from Sumatra.

Additional characters that differentiate *Paradrymonia peltatifolia* from its congeners are ovate to orbicular leaf blades (vs. elongate to broadly oblong) with dentate margins and white tubular corollas suffused with pink (vs. uniformly white, yellow, or red).

Paratypes. PANAMA. **Colón:** Distr. Donoso, Conseción de Minera Panamá S.A., Quebrada Colina, sendero to Sinaí, 300–400 m from camp. Colina, 8°50′9.4″N, 80°39′46.6″W, 200–220 m, 15 July 2011 (fl., fr.), *J. L. Clark & J. De Gracia 12450* (MO, PMA, SCZ, SEL, UNA, US); Distr. Donoso, Consec. Minera Panamá S.A., helipad ZP-P9, 8°51′5″N, 80°40′19″W, 391 m, 20 July 2011 (fl.), *J. L. Clark & L. Martinez 12578* (MO, PMA, SEL, UNA, US); Teck Cominco Mining Concession, Camp Colina, forests along Quebrada Colina, 8°49′50″N, 80°39′30″W, 152 m, 2 Mar. 2008 (fl.), *M. Merello & J. I. Gonzalez 3172* (MO).

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Studies in the Cleomaceae VII: Five New Combinations in *Corynandra*, an Earlier Name for *Arivela*

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Abstract. In the course of preparing our unpublished synopsis of the New World Cleomaceae, we found it desirable to make a number of changes in classification. Consequently, the genus *Corynandra* Schrad. ex Spreng., an earlier name for *Arivela* Raf., is re-established with *Corynandra chelidonii* (L. f.) Cochrane & Iltis [≡ *Cleome chelidonii* L. f.], *C. felina* (L. f.) Cochrane & Iltis [≡ *Cleome felina* L. f.], *C. flava* (Banks ex DC.) Cochrane & Iltis [≡ *Cleome flava* Banks ex DC.], and *C. viscosa* (L.) Cochrane & Iltis [≡ *Cleome viscosa* L.]. Also, one infraspecific combination is made, namely *Corynandra viscosa* subsp. *nagarjunakondensis* (Sundararagh.) Cochrane [≡ *Cleome viscosa* var. *nagarjunakondensis* Sundararagh.], and lectotypes are designated herein for *Polanisia leschenaultii* DC. and *P. viscosa* DC. var. *grandiflora* Benth.

Key words: *Arivela*, Cleomaceae, *Cleome*, *Corynandra*, Old World, *Polanisia*.

In contrast to the generic circumscription of *Cleome* L., s.l., which has been almost universally accepted by systematists for the past 70 or so years (e.g., Woodson, 1948; Iltis, 1950, 1952; Kers, 2003), we recently attempted to split *Cleome* into a number of segregate genera in the course of preparing our synopsis of Cleomaceae native to the New World (see Iltis & Cochrane, 2007, 2014). The question of subdividing *Cleome* into smaller, more clearly delimited genera is complicated by the fact that no modern attempt at taxonomic subdivision has treated the genus throughout its geographical range; generic delimitations among African, Near Eastern, and Australian Cleomaceae have not been subject to much discussion. It will probably only be a matter of time before the course of generic segregation is extended to Old World members of the family. In any case, we resurrect the name *Corynandra* Schrad. ex Spreng. for our own work, taking into account two issues: acceptance of a segregate genus and adoption of the earliest legitimate name for that genus. We do not anticipate there will be any taxonomic conflict over competing names, because, except for the common and widespread plant normally identified as *Cleome viscosa* L., which has been treated as *Arivela viscosa* (L.) Raf. in recent floristic literature (Zhang & Tucker, 2008; Tucker & Vanderpool, 2010; Acevedo-Rodríguez & Strong, 2012), the species are now invariably placed in *Cleome* or *Polanisia* Raf. *Arivela* Raf. is a name that prior to five years ago had never been used since its original publication; and, significantly, it is one for which *Corynandra* is an earlier legitimate name with the same rank.

Corynandra Schrad. ex Spreng.

Schrader used and depicted *Corynandra pulchella* Schrad. ex Spreng. in correspondence with de Candolle ("*in litt. cum icone eximia*. (v.s.)," de Candolle, 1826: 57; Schultes, 1829), and he used the name in two issues (1825, 1826) of the *Index Seminum Horti Academici Gottingensis*. However, the name did not later appear in the subsequent indices of 1827 and 1828, suggesting that the plant did not survive in the garden at Göttingen. Schrader's presumed intention to create a new genus was validated by Sprengel (1827), who provided effectively published descriptions for both the generic and binary names. During this same period, descriptions of *C. pulchella* were also published by de Candolle (as *Polanisia* "*schaderi*" DC., 1826), Reichenbach (1828), and Schultes (as *Cleome schraderi* (DC.) Schult. f., 1829). Apparently, Reichenbach (1828) and Schultes (1829) had access to the 1826 seed list mentioned above, which was subsequently cited by Pax and Hoffmann (with its date misquoted, 1936), and Iltis (1960), in all four instances with a misleading title.

With few exceptions, e.g., Sprengel (1827) and Reichenbach (1828), authors have retained *Corynandra* within a broadly circumscribed *Polanisia* or affiliated with *Cleome*, although some (Schultes, 1829; Endlicher, 1839; Kuntze in Post & Kuntze, 1904; Pax & Hoffmann, 1936) have used the genus name again at subgeneric rank. Nevertheless, Rafinesque (1838), apparently unaware of publications pertaining to Schrader's 1827 name, proposed various genera segregated from *Cleome*. Two of them,

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Arivela and *Aubion* Raf., are synonymous with *Corynandra*. Iltis (1960) included *Corynandra* and Rafinesque's two genera in synonymy under *Cleome* sect. *Ranmanissa* (Endl.) Griseb. *Arivela* was erected for a single common variable species, *Arivela viscosa* (L.) Raf., familiarly known as *Cleome viscosa* L., and was characterized by Rafinesque as having unequal petals and eight to 15 unequal stamens. *Aubion* was established for its type and only species, *Aubion chelidonii* (L. f.) Raf. (as "*chelidoni*"), which was said to have five petals, many stamens, and hispid seeds [sic, for verrucose, varying to irregularly verruculose].

Arivela has recently been taken up by Zhang and Tucker (2008) and Tucker and Vanderpool (2010), who reckon that it encompasses about 10 species. In so doing, they have followed Iltis and Cochrane (2007) in recognizing segregate genera for species formerly included in *Cleome*. However, there is no doubt that *Corynandra* is the older name vis-à-vis *Arivela*. *Corynandra* is characterized by the closed aestivation of the flowers (the petals enclosing the stamens in bud until close to anthesis); high number of stamens (about 10 to 100 plus, sometimes fewer in Australian species), the adaxial (if not all) filaments of which are more or less apophysate; sessile, typically erect capsules with persistent valves that dehisce from the apex; and open seed cleft. The solitary flowers borne in the axils of upper leaves and an obsolete disk are additional associated features. Although frequently referred to *Polanisia* owing to the similarly high number of stamens, *Corynandra* can be distinguished by the closed corolla aestivation; open seed cleft; unspecialized disk; uniform maturation of the stamens; entire petal margins; and except for the pantropic weed *Corynandra viscosa* (L.) Cochrane & Iltis, of entirely Old World geographic distribution (see Iltis, 1958). Given the paucity of comprehensive accounts of *Cleome*, s.l., in the Old World and the meagerness of available herbarium material, it is difficult to gain an understanding of the size of *Corynandra*, or the distribution, frequency, and habitats of the component species, let alone its relationships to other cleomoid groups. Besides *Corynandra viscosa*, the species most obviously belonging here, *C. chelidonii* (L. f.) Cochrane & Iltis (and its synonym *C. pulchella*, the only binomial published in the genus until now), *C. felina* (L. f.) Cochrane & Iltis, and *C. flava* (Banks ex DC.) Cochrane & Iltis, are herein transferred to *Corynandra*. We are uncertain as to the remaining species in Schrader's genus, although additional if not all native Australian species almost certainly belong here, especially in view of the phylogenetic analyses carried out by Feodorova et al. (2010), which placed *C. viscosa* together with five Australian cleomes in a distinct clade within a paraphyletic *Cleome*. Other new combinations will likely be required.

1. Corynandra chelidonii (L. f.) Cochrane & Iltis, comb. nov. Basionym: *Cleome chelidonii* L. f., Suppl. Pl. 300. 1781 [Apr. 1782]. *Polanisia chelidonii* (L. f.) DC., Prodr. 1: 242. 1824, non *Cleome chelidonii* Bojer, Ann. Sci. Nat., Bot. Sér. 2, 20: 56. 1843. [= *Cleome strigosa* (Bojer) Oliv.] TYPE: [India.] Ind. Orient. ["prope Tanschaur," fide L. f., 1781: 300], s.d., *J. G. Koenig s.n.* (holotype, BM-522348).

Polanisia angulata DC., Prodr. 1: 242. 1824. *Cleome angulata* (DC.) Schult. f., Syst. Veg., ed. 15 bis [Roemer & Schultes] 7(1): 45. 1829. TYPE: [Indonesia.] Java, *J. B. L. T. Leschenault 27* (holotype, P-741941, P digital image at WIS).

Polanisia leschenaultii DC., Pl. Rar. Jard. Genève, Fasc. 3: 57. 1826 [often incorrectly cited as Prodr. 1: 242. 1824]. *Cleome leschenaultii* (DC.) Schult. f., Syst. Veg., ed. 15 bis [Roemer & Schultes] 7(1): 49. 1829. TYPE: [India.] "Indes orient., interieur de la peninsule," *J. B. L. T. Leschenault 252* (lectotype, designated here, P-5392629, P digital image at WIS; isolectotype, P-5392625, P digital image at WIS).

Corynandra pulchella Schrad. ex Spreng., Syst. Veg., ed. 16, 4(2, Cur. Post.): 204. 1827. *Polanisia schraderi* DC., Pl. Rar. Jard. Genève, Fasc. 3: 57. 1826 [often incorrectly cited as Prodr. 1: 242. 1824], nom. inval. *Cleome schraderi* (DC.) Schult. f., Syst. Veg., ed. 15 bis [Roemer & Schultes] 7(1): 48. 1829, nom. inval. TYPE: unknown Asia, cult. hort., *H. G. L. Reichenbach s.n.* (holotype, B-100365582, ex herb. Sprengel via herb. Reichenbach, B digital image at WIS).

Cleome chelidonii L. f. var. *pallae* C. S. Reddy & V. S. Raju, J. Econ. Taxon. Bot. 25(1): 217. 2001. TYPE: India. Andhra Pradesh: Warangal Distr., Pakhal RF, *K. M. Sebastine 13106* (holotype, MH, fide Reddy & Raju [2001], not seen).

Leschenault's handwritten slip on the holotype of *Polanisia angulata* transmits the collection number: "No. 27. De mon journal." The specimen must be referred here in synonymy to *Corynandra chelidonii* on the basis of fruit morphology and de Candolle's (1824: 242) record of the collector's note "Flores violacei," an attribute that among Malaysian Cleomaceae applies only to *C. chelidonii*.

Leschenault material held by the Muséum National d'Histoire Naturelle under the name *Polanisia chelidonii* is represented by two specimens, both bearing the collector's original label. Because the one marked with the script epithet "Lechenaultii" is accepted as having been used by de Candolle, it was selected as the lectotype for *P. leschenaultii* even though both specimens must have seen by him. The fact that P-5392629 bears many leaves and fruits but no flowers, whereas P-5392625 has six flowers but no

fruits and extremely poor leaves, leads to the supposition that both specimens were in hand, because all three organs—leaves, flowers, and fruits—were described by de Candolle.

As far as could be established, *Polanisia heterophylla* Wall. (Numer. List [Wallich] no. 6970. 1832), a name assigned to synonymy under *Cleome chelidonii*, e.g., by Hooker and Thomson (1872), has not been validated by a description and is thus a nomen nudum.

Corynandra chelidonii ranges from southern India and Sri Lanka eastward to Thailand and East Java (Jacobs, 1960; Ramesh, 1984; Chayamarit, 1987; Philcox, 1996), where it is occasional to common in moist to desiccated, but usually muddy, places at elevations up to 120 m, such as freshwater swamps, ditches, and edges of rice and sugarcane fields (Jacobs, 1960; Backer & Bakhuizen van den Brink, 1963; Sundararaghavan, 1993). Plants of *C. chelidonii* are much branched in habit with stems that are glabrous or sparsely prickly with pustulate-based hairs; long-petioled, 3- to 7-(to 9-) foliolate leaves; white, pink, or bright rose-purple flowers with many stamens (over 30 to 65 or more); and slenderly cylindric, glabrous, prominently longitudinally veined capsules 4.5–9 cm long.

2. Corynandra felina (L. f.) Cochrane & Iltis, comb. nov. Basionym: *Cleome felina* L. f., Suppl. Pl. 300. 1781 [1782]. *Polanisia felina* (L. f.) DC., Prodr. 1: 242. 1824. TYPE: [Sri Lanka. "*Habitat* in Zeylona," fide L. f., 1781: 300], 1777, *J. G. Koenig* (holotype, LINN 850.9, LINN digital image at WIS).

Corynandra felina is endemic to peninsular India (Hooker & Thomson, 1872; Sundararaghavan, 1993; Kundu, 2007). It can be quickly recognized by its rough indument of rigid, almost scalelike, prickly hairs, 3-foliolate leaves with relatively small leaflets, and bristly calyx and corolla, as well as its relatively stable stamen number (28 to 32, fide Hooker & Thomson, 1872), compressed glabrous capsules, and distinctive seeds, which are covered for the most part by a helmet-shaped, pithy outer layer.

3. Corynandra flava (Banks ex DC.) Cochrane & Iltis, comb. nov. Basionym: *Cleome flava* Banks ex DC., Prodr. 1: 241. 1824. TYPE: Australia. [Queensland:] Endeavor River, 1770, *J. Banks* (BM, BM photo at WIS).

Polanisia viscosa DC. var. *grandiflora* Benth., Fl. Austral. 1: 91. 1863, syn. nov. *Cleome grandiflora* (Benth.) F. Muell., Pl. Coll. Capricornic W. Australia H. S. King. 1886: in obs., nom. illeg., non *Cleome grandiflora* Ehrenb. ex Schweinf., Beitr. Fl. Aethiop. 71. 1867. TYPE: [Australia. Queensland:] Sweers Island, s.d., *D. Henne s.n.* (lectotype, designated here, NSW, NSW photos at WIS; isolectotypes, MEL, W, W fragm. at WIS).

Corynandra flava appears to have a restricted distribution. Although we have seen specimens only from the northern coast of Australia (*Brown 4937*, BM; *Must 596*, WIS; *Specht 278*, AD, K, US, US fragm. at WIS; *Spencer Expedition s.n.* in 1911, NSW), as well as the type from Queensland, we perhaps cannot be entirely confident that it is endemic in view of the amount of variation present in *C. viscosa* s.l., within which it has been routinely subsumed, e.g., by Bentham (1863) and Hewson (1982). More recently, Australian botanists have recognized the existence of this large-flowered coastal taxon, which in the Northern Territory Herbarium is being curated under the phrase-name "*Cleome* sp. large coastal (*Barritt 1797*)" (Short, 2010: 10). Although the relatively well-developed racemes of *C. flava* are quite different from the mostly solitary flowers of *C. viscosa*, in general habit and flower and fruit characteristics *C. flava* is clearly very closely related to that species. Because the species is poorly known, we present the following couplet based upon the aforementioned collections as well as the type collection:

1a. Petals 7–14(–15) × 3–5 mm; plants more or less densely glandular-pubescent throughout; flowers solitary in the axils of the upper leaves, the racemes generally not defined except near the tip; sepals narrowly elliptic to oblanceolate-elliptic, 4–10 × 1–4 mm, glandular-pubescent; stamens 10 to 20(to 26); capsules generally 3–8(–10) cm; style in fruit 1–6 mm; stigma crateriform-capitate, 0.7–0.9 mm in diam ..... *Corynandra viscosa*

1b. Petals (14–)15–25 × 4–10 mm; plants subglabrous to only slightly pubescent; flowers mostly in well-defined racemes, the subtending bracts much smaller than the foliage leaves; sepals broadly elliptic, 7–11 × 3–4 mm, essentially glabrous; stamens 24 to 35; capsules generally (7–)8–13 cm; style in fruit 5–9 mm; stigma capitellate, drying bilobed, 0.6–0.8 mm across ..... *Corynandra flava*

Beyond the couplet above, *Corynandra flava* further differs from *C. viscosa* in tending to have the leaflets small and rather narrow, 11–38 × 3–12 mm, with remotely and faintly denticulate margins rather than entire, glandular-ciliate margins. The sepals are glabrous to sparsely puberulent with short gland-tipped hairs that are concentrated near the base and along the midvein or on the thin margins. The shorter stamens (ca. 10 mm) have a small apophysis a short distance below the anther, whereas the longer ones (ca. 15 mm) lack apophyses.

4. Corynandra viscosa (L.) Cochrane & Iltis, comb. nov. Basionym: *Cleome viscosa* L., Sp. Pl. 672. 1753. *Sinapistrum viscosum* (L.) Moench, Suppl. Meth. 83. 1802. *Polanisia viscosa* (L.) DC., Prodr. 1: 242. 1824. *Polanisia viscosa* Blume, Bijdr. Fl. Ned. Ind. 2: 52. 1825 [generally cited as a nom. illeg. but regarded by J. F. Veldkamp (pers. comm.) as a literature reference, not a new taxon or combination based on the same type (isonym)]. *Arivela viscosa* (L.) Raf., Sylva Tellur. 110. 1838. TYPE: Ceylon [Sri Lanka]. Herb. *P. Hermann* 3: 2, No. 241 (lectotype, designated by Du Puy & Telford [1993: 169], BM-SL-621795).

Additional synonyms may be found in Iltis (1960: 281), Jacobs (1960: 103), and Elffers et al. (1964: 11).

4a. Corynandra viscosa subsp. **viscosa.**

Corynandra viscosa is probably native to tropical Asia but has long since become a common pantropic weed, especially in light soils, occurring from southern Arabia and tropical Africa across Asia (including Malaysia) to tropical Australia in the Old World (Philcox, 1996; Zhang & Tucker, 2008) and from the West Indies to Central America, Mexico, and sporadically, the United States in the New World (Iltis, 1960; Acevedo-Rodríguez & Strong, 2012). There is a single report of its occurrence as an adventive species in Europe (Ferrer & Laguna, 2010). It is easily recognized among all American cleomoid species by its bright yellow petals, many stamens (eight to 30), and erect sessile, distinctly veiny fruits that dehisce from the apex. The flowers are solitary in the axils of leaves, the racemes being generally not defined except near the apex. The typical variety is covered throughout with a more or less dense, yellowish to brownish, mostly glandular indument, and, in addition, it is malodorous.

Most specimens are very pubescent, but a variant occurring at low elevations in China, Indonesia, Malaysia, Vietnam (Zhang & Tucker, 2008), and northern Australia (Domin, 1926) is glabrous throughout and lacks a distinct smell. Backer (1907: 53) provided the basionym for this well-marked form of the species, naming it *Polanisia viscosa* var. *deglabrata* Backer, which is sometimes accepted as a distinct entity variously called *Cleome viscosa* f. *deglabrata* (Backer) M. Jacobs, *C. viscosa* var. *deglabrata* (Backer) B. S. Sun, or *Arivela viscosa* var. *deglabrata* (Backer) M. L. Zhang & G. C. Tucker (note that *P. icosandra* Wight & Arn. f. *deglabrata* (Backer) Backer is an invalid name). However, Backer seems to have been uncertain with respect to his synonymy. In an obvious attempt to match his specimens with existing literature, he listed "?Polanisia angulata" as a synonym and referred to texts by de Candolle (1824) and Miquel (1859, 1871), in each of which the name *P. angulata* DC. appears, albeit in two of the three works with a question mark. Miquel, who accepted *P. angulata* as a species, initially (1859) copied de Candolle's question mark and (except for a small change in the number of leaflets) his diagnosis but eventually (1871) dropped the query. The question mark, even if a relic from de Candolle, who, ignorant of stamen number, was unsure whether to list *P. angulata* under *Cleome* or *Polanisia*, also implies uncertainty on Backer's part as to the relationship of his new variety to de Candolle's species.

The question of typification of *Polanisia viscosa* var. *deglabrata* seems to have been ignored. Backer did not designate a holotype; indeed, he cited no specimen at all, although he did direct attention to the works by de Candolle and Miquel specified in the preceding paragraph. The possibility that any of the specimens cited therein might serve as the lectotype must be dismissed. Two of the three references cite only the Leschenault sheet, i.e., *Leschenault de la Tour 27* (P-741941 [digital image at WIS]), under ?*P. angulata*. It serves as the type and is conspecific with *Corynandra chelidonii* (see synonymy under *C. chelidonii* above; see Jacobs, 1960). The third, Miquel's 1871 work, abandons the question mark and cites material of three collectors; but apart from the fact that the specimens are presumably *C. chelidonii*, having been identified by Miquel as *P. angulata*, they cannot be used because of Backer's question mark appended to the synonym in the protologue.

Furthermore, the *ICN* requires (Art. 9.2, 9.12; McNeill et al., 2012) that the lectotype must be chosen from among relevant original material. In 1907 Backer was in Java and had not examined the specimens cited in his sources, which therefore do not constitute indirect references to type material. There is no pre-1907 specimen annotated by him with the epithet *deglabrata* in L or U (now in L) (fide J. F. Veldkamp, pers. comm.). Uncited material from which a lectotype can be chosen may, however, exist in BO.

In the protologue Backer stated that *Polanisia viscosa* var. *deglabrata* grew together with the typical variety and later noted (Backer & Bakhuizen van den Brink, 1963: 182) that it occurred "here and there," implying that it lacked any ecologic or geographic integrity. Therefore, should a new combination be published, the rank of forma, eventually adopted by Backer himself (as "form," perhaps in the sense of type, 1941, 1942; explicitly as forma, Backer &

Bakhuizen van den Brink, 1963), would probably be appropriate.

We are not sure of the identity of *Polanisia viscosa* var. *speciosa* Domin, because we have not seen the type (Queensland: Cloncurry, Feb. 1910, *K. Domin*, coll. no. and herbarium not traced). The original description suggests that the plants are too strongly glandular-hirsute to be *Corynandra flava* and too large-flowered to be *C. viscosa*.

4b. Corynandra viscosa subsp. **nagarjunakondensis** (Sundararagh.) Cochrane, comb. et stat. nov. Basionym: *Cleome viscosa* var. *nagarjunakondensis* Sundararagh., Bull. Bot. Surv. India 28: 187. 1986 [1988]. TYPE: India. Andhra Pradesh: Nagarjunakonda Hills, Nalgonda Distr., 13 July 1961, *K. Thothathri 9616* (holotype, BSI?; isotypes, BSI?, CAL-25069, CAL digitized image at WIS).

For *Cleome viscosa* var. *nagarjunakondensis*, Sundararaghavan (1986) cited as type four specimens of "*K. Thothathri 6616*" in CAL, but only one is deposited there, and staff botanists are convinced it is an isotype. Furthermore, the collector's handwritten label on the isotype, although otherwise agreeing exactly with the protologue, gives "No. 9616." Thus, 6616 is a reading or printing error. Additional type material might be preserved in BSI, where the author of the variety worked.

This taxon is known only from deciduous forests in the large Indian state of Andhra Pradesh (Sundararaghavan, 1986, 1993) and was separated primarily on the basis of stamen number and style length. Flowers of *Corynandra viscosa* subsp. *viscosa* have (8)12 to 26 stamens, and capsules have styles 1–6 mm long, whereas the stamens of *C. viscosa* subsp. *nagarjunakondensis* number 36 to 40, and the fruit styles measure 12–20 mm. Flowers of the latter have sepals 8–12 mm long and petals 18–25 mm long and thus are as large as those of *C. flava* (see above), but the stamens are more numerous and the ovary glandular-pubescent.

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Retiniphyllum francoanum (Rubiaceae), a New Species from the Colombian Guayana

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Abstract. *Retiniphyllum francoanum* Cortés-Ballén (Rubiaceae), a species restricted to the westernmost limit of the Guayana Shield in Colombia, is described. It differs from the other known species of the genus by the ovaries with seven or eight locules, and from its closest relative, *R. secundiflorum* Bonpl., by the shorter inflorescences, bracteole shape, colleters inside bracteoles, longer corolla tube, turbinate ovary, and by the winged and smaller pyrenes.

Resumen. Se describe *Retiniphyllum francoanum* Cortés-Ballén (Rubiaceae), una especie restringida a la parte mas occidental del Escudo de la Guayana en Colombia. Se diferencia de las 21 especies del género por tener ovarios con siete u ocho loculos, y de la especie mas cercana, *R. secundiflorum* Bonpl., por las inflorescencias mas cortas, la forma de las bracteolas, los coléteres dentro de las bracteolas, el tubo de la corola mas largo, el ovario turbinado, y por los pirenos alados y mas pequeños.

Key words: Colombia, Guayana Shield, IUCN Red List, *Retiniphyllum*, Rubiaceae.

Retiniphyllum Bonpl. (Rubiaceae) is a Neotropical genus with 22 species of shrubs and small trees. The center of diversity of the genus is the Guayana Shield; however, some species are also distributed in the Amazon basin and the Brazilian Shield, and two species extend to the eastern Andes. Most species of the genus are easy to identify by the abundant resin secreted by colleters that cover their buds, young branches, and inflorescences (hence the generic name). Species of *Retiniphyllum* exhibit some remarkable traits among the Rubiaceae, such as bracteoles at the pedicel bases; an involucel (calyculus) inserted at the pedicel apices; ovaries commonly pentalocular with two collateral pendulous ovules per locule; and drupaceous fruits with five pyrenes in most species, commonly containing a single seed per pyrene due to the abortion of one ovule. Steyermark (1965) published a synopsis of the genus that included 21 species, and later presented a detailed description of the 10 species occurring in Venezuela (Steyermark, 1974). The latter contribution was updated for the series Flora of the Venezuelan Guayana (Taylor et al., 2004). *Retiniphyllum* is the single genus of the Retiniphylleae, the sister tribe of the core members of the subfamily Ixoroideae s. str. (Cortés-B. et al., 2009). The monophyly of both the genus and the tribe was confirmed by Cortés-B. et al. (2009).

While preparing the treatment of the genus for the Flora Neotropica series, I found a species that clearly differs from the known species, mainly by the ovaries with seven or eight locules. The undescribed species also exhibits some traits not common in the genus, such as the leaves canescent below, axillary inflorescences, fruits with two seeds per locule, and involucels persistent on the fruits. The new species is restricted to two localities in southeastern Colombia: the Mesa de Araracuara, a sandstone plateau between 300 and 350 m in elevation; and the Sierra de Chiribiquete, a series of sandstone table mountains that reach 840 m in elevation. Both locations lie at the western border of the Guayana Shield. The new species is one of many shared by Araracuara and Chiribiquete, areas with very strong floristic affinities, probably due to their common geologic history and proximity (Cleef & Duivenvoorden, 1994; Cortés-B. & Franco, 1997).

Retiniphyllum francoanum Cortés-Ballén, sp. nov. TYPE: Colombia. Caquetá: Sierra de Chiribiquete, S camp, lt. side of river, up river of major waterfall, 300 m, 6 Dec. 1990 (fl.), *J. Estrada, J. Fuertes, P. Franco & P. Palacios 646* (holotype, COL; isotypes, COL, K, MO, NY, UDBC). Figure 1.

Species nova *Retiniphyllo secundifloro* Bonpl. affinis, sed ab eo inflorescentiis brevioribus (0.7–4.2 cm longis), bracteolis reductis (non foliaceis) colleteribus praeditis, ovario turbinato et pyrenis alatis brevioribus differt.

Shrubs to 3 m tall; leafy branches terete, 2.5–3.5 mm diam., minutely hirtellous; stipules tubular, free portion broadly triangular, 4.8–9.2 × 3.4–6 mm, acute, acuminate or rarely bilobed at apex, margin entire or

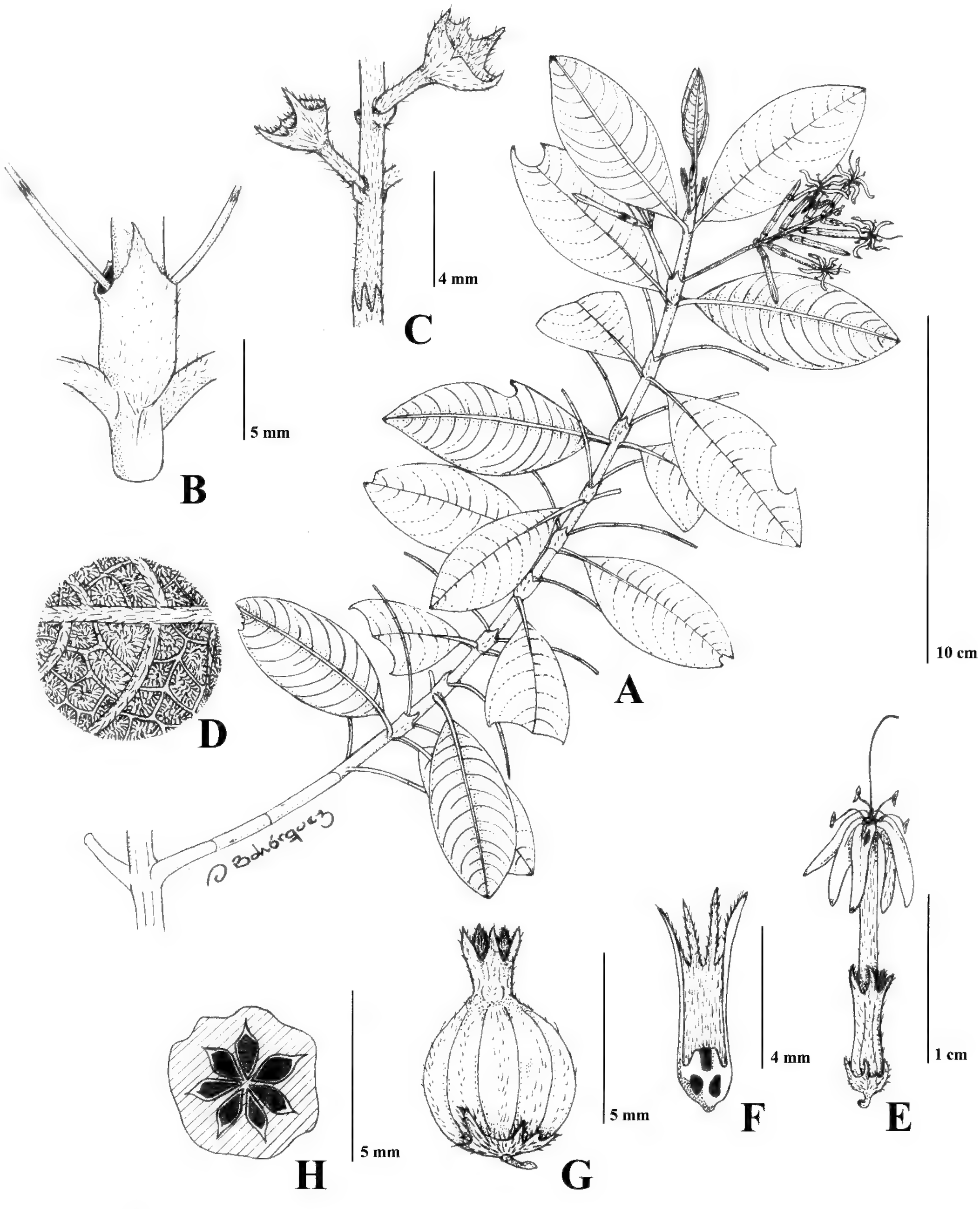


Figure 1. *Retiniphyllum francoanum* Cortés-Ballén. —A. Flowering branch. —B. Stipule. —C. Inflorescence rachis with reduced bracteoles at the base of two pedicels and cupular involucels at pedicel apices. —D. Detail of lower surface of leaf blade, showing veins with strigose indument and tomentose areoles. —E. Flower at anthesis. —F. Portion of flower, dissected, showing ovary and calyx. —G. Fruit with persistent involucel at the base. —H. Transverse section of fruit. A–D drawn from the paratype *D. Cárdenas et al. 6929* (COAH); E and G from the paratype *J. Duivenvoorden & A. Cleef 312* (COAH); F and H from the paratype *N. Hernández & M. C. Peñuela 172* (COAH).

serrulate, coriaceous, strigose outside, glabrous and with colleters from base to middle portion inside, caducous. Leaves petiolate; petioles 5–11 × 1.1–3 mm, hispidulous; blades 3.1–8.8 × 0.9–4.5 cm, length:width ratio 2:1–3.4:1, elliptic, oblong-elliptic or obovate, cuneate at base, acute or round at apex, coriaceous, with strigose hairs at margin and along primary vein above, canescent below; primary,

secondary, and tertiary veins strigose below, areoles tomentose below; secondary venation eucamptodromous, 11 or 12 veins each side, tertiary veins randomly reticulate; pocket domatia present or absent. Inflorescences axillary, racemose, erect, 4- to 11-flowered; 0.7–4.2 cm; rachis slightly ridged or terete, 0.5–1 mm wide, hirtellous, with or without a stipular collar subtending the basal pair of flowers; peduncle 2–12 mm, hirtellous; bracteoles reduced, margin entire or with minute teeth to 0.6 mm, glabrous, with colleters inside; involucel cupular, lobulate, 1–2.5 × 1.8–2.6 mm, with 3 to 6 lobes of different sizes, 2 larger lobes narrowly triangular, 0.8–1.5 × 0.3–0.4 mm, 1 to 4 smaller lobes deltoid, 0.2–0.5 mm, strigose outside, hispid and with colleters at base inside, persistent to the fruit. Flower buds cylindrical, tube straight or rarely slightly bent; flowers actinomorphic, pedicellate; pedicels 1.8–2.7 × 0.5–0.6 mm, hirsute; calyx tubular, 2.6–5 × 1.9–2.4 mm, lobulate, strigose outside, hispid and with colleters inside; lobes 1.2–2.5 × 0.3–0.5 mm, narrowly triangular, strigose, microscopically verrucose, green; corolla red, 21–28 mm; tube infundibuliform, 15–21 mm, 2–3.5 mm wide at the orifice, 1–1.5 mm wide at the base, sericeous outside, with a ring of hairs at the base inside, 1–1.5 mm wide at 2.5–4.3 mm from base, glabrous below ring, strigose above ring; lobes 1/3 to 1/4 of tube length, 5–7 × 0.7–1.6 mm, lanceolate, acute at apex, sericeous throughout; staminal filaments 3.3–4.2 × 0.1–0.3 mm, slightly expanded at base, pilose throughout; anthers elongate, 1.7–2 × 0.2–0.5 mm; basal appendages oblong, 0.3 mm, truncate at base; apical appendages narrowly triangular, 0.1–0.2 mm; style 24–26 × 0.3–0.6 mm, pilose at base and medial portion, glabrous distally, capitate portion oblong before branching, style branches narrowly triangular, to 0.2 mm; ovary 7- or 8-locular, turbinate, 1–1.3 × 1.4–1.5 mm, pubescent; disk to 0.8 mm. Fruit oblate, 3.8–5 × 4.1–6 mm, glabrous, strigose only apically; pyrenes 2.9–3 × 1.8 mm, surface verrucose, with 2 parallel wings inserted near the ventral margin; seeds 2 per locule, cylindrical, attached at distal portion of the septum, 2.5 × 1 mm.

Distribution, habitat, and phenology. *Retiniphyllum francoanum* has been found only in the Mesa de Araracuara and the Sierra de Chiribiquete in the departments of Amazonas, Caquetá, and Guaviare, Colombia, at elevations from 100 to 350 m. Flowering specimens were collected in January, April, July, and September through December; fruiting specimens were collected from October to December.

IUCN Red List category. The available evidence indicates that *Retiniphyllum francoanum* meets two of the criteria for the category of Vulnerable (VU) (IUCN, 2012). The estimated extent of occurrence of this species is less than 20,000 km², and it has been recorded in no more than 10 locations. In addition, I was unable to find this species in a recent field expedition to the Mesa de Araracuara, indicating a probable declining number of subpopulations there. Subpopulations of *R. francoanum* located at the Sierra de Chiribiquete may not be under the same threat due to the area's protected status and difficult access; however, the criteria for placement in the Vulnerable category are met, nevertheless.

Etymology. This species is named in honor of professor Pilar Franco (1950–2000), who was directly involved with the collection of this species.

Discussion. *Retiniphyllum francoanum* is unique in the genus by having ovaries with seven or eight locules. The ovary in all the other species of *Retiniphyllum* is commonly pentalocular, although it might be 5- or 6-locular in *R. secundiflorum*, 6-locular in *R. laxiflorum* (Benth.) N. E. Br. var. *brasiliense* Steyerm., and 4- or 5-locular in *R. tepuiense* Steyerm. *Retiniphyllum francoanum* and *R. secundiflorum* are sister species, sharing unique characters in the genus such as the leaves canescent below, axillary inflorescences, fruits with two seeds per locule, and the involucels persistent to the fruits (Cortés-B, 2003). The new species differs from *R. secundiflorum* in having inflorescences 0.7–4.2 cm long (vs. 5–16 cm long in *R. secundiflorum*), rachises 0.5–1 mm wide (vs. 0.9–1.8 mm wide), reduced bracteoles (vs. foliose), bracteoles with colleters (vs. without colleters), corolla lobes 1/3 to 1/4 of the tube length (vs. 1/2–2/3), turbinate ovaries (vs. ellipsoid), winged pyrenes (vs. slightly ribbed), and pyrenes 2.9–3 mm long (vs. 4 mm long).

Retiniphyllum francoanum grows on rocky outcrops but has also been collected from the most common vegetation types found in the Colombian part of the Guyana region, such as shrublands over white sand and low forest dominated by *Bonnetia sessilis* Benth. (Clusiaceae), as reported by Estrada and Fuertes (1993), Rangel et al. (1995), and Arbeláez and Callejas (1999). According to these authors, the extreme conditions of these areas, including high temperatures and poor soils, make diverse plants look rachitic and sclerotic, occasionally with persistent old parts. This is the case with *R. francoanum*, a rachitic shrub that retains the rachises of old inflorescences for a long time before they fall (Fig. 1).

Paratypes. COLOMBIA. **Amazonas:** Correg. Puerto Santander, SW of Araracuara, Sabana de Aduche, Cabecera de Tibelle, rd. to La Chorrera, 0°5′S, 72°20′W, 100–350 m,

23 Nov. 1993, *D. Cárdenas et al. 4152* (COAH). **Caquetá:** Río Caquetá, Araracuara, 1 Apr. 1976, *C. Sastre & H. Reichel 5133* (COL, VEN); Mun. Solano, lt. margin of Río Caquetá, Paujil (Caño Paujil), 10 km NW from Araracuara, 0°45′–48′S, 72°20′–25′W, 100–350 m, 24 July 1992, *M. V. Arbeláez & F. Sueroque 167* (COAH, HUA, MO), 16 Oct. 1992, *M. V. Arbeláez & F. Sueroque 213* (COAH, HUA); Araracuara, behind military base, 0°37′S, 72°24′W, 18 Oct. 1990, *J. Duivenvoorden & A. Cleef 312* (COAH); Río Caquetá, Araracuara, rd. to La Chorrera, 8 Sep. 1991, *H. Vester 504* (COAH); Parque Nac. Nat. Chiribiquete, raudal del Río Sararamano, 29 Jan. 1992, *Puerto Rastrojo 1992* (NY); Serrania de Chiribiquete, sector nororiental, Río Cuñare, raudal El Tubo, 28 Nov. 1995, *D. Cárdenas et al. 6929* (COAH, MO); Parque Nac. Nat. Chiribiquete, Río Cuñare, raudal El Tubo, 0°26′N, 72°30.5′W, 10 Nov. 1996, *N. Hernández & M. C. Peñuela 172* (COAH); Mun. Solano, PNN Serranía de Chiribiquete, lt. margin of Río Mesay, at level of Chorro La Reina, 0°14′N, 72°56′W, 350 m, 1 Jan. 2000, *L. F. Prado et al. 669* (COAH).

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Haematoxylum calakmulense (Leguminosae, Caesalpinoideae), una Nueva Especie Mesoamericana

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RESUMEN. Se describe e ilustra una nueva especie mesoamericana de la Península de Yucatán, *Haematoxylum calakmulense* Cruz Durán & M. Sousa (Leguminosae, Caesalpinoideae). Esta nueva entidad es similar a *H. campechianum* L., sin embargo difiere de esta por presentar un mayor número de folíolos, hasta seis pares, de menor tamaño, de consistencia crasa y venación secundaria poco evidente; el raquis y el pecíolo presentan pelos uncinados blancos, y los folíolos tienen pelos blancos cerca de la base por el envés; las inflorescencias son más cortas, no más de 4.5 cm, el raquis de la inflorescencia, pedicelos y cáliz son siempre pilosos, y los pétalos son de menor tamaño. Se incluye también una clave para distinguir las especies conocidas del género *Haematoxylum* L.

ABSTRACT. *Haematoxylum calakmulense* Cruz Durán & M. Sousa (Leguminosae, Caesalpinoideae), a new Mesoamerican species from the Yucatan Peninsula, is described and illustrated. This new species is similar to *H. campechianum* L., but differs by having more leaflets, up to six pairs, that are smaller and thick, with secondary venation non-evident; the rachis and petiole always with uncinate white trichomes, while the leaflets present with white trichomes on the abaxial surface toward the base; the inflorescences are shorter, no more than 4.5 cm, the inflorescence rachis, pedicels, and calyx are always pilose and the petals are smaller. A dichotomous key to distinguish the known species of *Haematoxylum* L. is included.

Key words: Belize, Caesalpinoideae, Campeche, Guatemala, *Haematoxylum*, IUCN Red List, Leguminosae, Mesoamerica, Mexico, Península de Yucatán, Quintana Roo, Yucatan.

El género *Haematoxylum* L. (Leguminosae, Caesalpinoideae) es un género de difícil taxonomía. Entre los caracteres útiles están el número y forma de los folíolos, la longitud de las inflorescencias, la forma y el tamaño de las flores, particularmente del hipantio. En menor grado están la consistencia y venación de los folíolos y la pelosidad de partes vegetativas y fértiles.

De acuerdo con Polhill y Vidal (1981) y Lewis (2005), este género se incluye en la tribu Caesalpinieae, grupo *Caesalpinia* L., que se caracteriza por presentar braquiblastos, espinas, frutos no segmentados con hipantio persistente, folíolos con nervios muy próximos entre sí y sépalos que se desprenden del hipantio.

Haematoxylum incluye árboles o arbustos, con espinas cónicas en las ramas, y hojas pinnadas con dos a cuatro(a seis) pares de folíolos, en ocasiones bipinnadas en las pinnas basales; los folíolos son obovados a orbiculares, generalmente más largos que anchos, de base cuneada, margen entero, y ápice obtuso a emarginado. Las inflorescencias en este género son racimos, solitarios o fasciculados, a partir de braquiblastos; las flores son actinomorfas o zigomorfas, con hipantio cupuliforme o cimbiforme, en ocasiones piloso; con cinco sépalos, generalmente amarillos, el carinal cimbiforme; con cinco pétalos amarillos, obovados u oblanceolados, en ocasiones con el estandarte más largo que los demás; con 10 estambres amarillos, los filamentos pilosos hacia la base; estilo glabro con estigma tubular o crateriforme; y legumbres fusiformes a oblongas, con hipantio persistente.

Hasta ahora se conocen cuatro especies del género *Haematoxylum*: *H. dinteri* Harms, endémica de Namibia, África; y el resto de América tropical, *H. campechianum* L., con distribución en la región Mesoamericana, que incluye los estados de Campeche, Quintana Roo y Yucatán en México, así como Guatemala y Belice (Península de Yucatán); *H.*

brasiletto H. Karst., con amplia distribución desde el norte de México hasta Colombia (McVaugh, 1987); y *H. sousanum* Cruz Durán & J. Jiménez Ram., en la depresión del río Balsas, en los estados de Guerrero, Oaxaca y Puebla, en México (Cruz & Jiménez, 2008).

De acuerdo a Miranda (1958) y Sarukhán y Pennington (1998), en la denominada selva baja subperennifolia se conoce como "tintal" a una asociación vegetal que se presenta en sitios periódica o casi constantemente inundados, denominados hondonadas o ak'alche, en donde el suelo es plano, profundo y arcilloso, y que debido a la deficiencia de drenaje permite la acumulación de agua de lluvia. Estas asociaciones vegetales que en ocasiones alcanzan hasta 10 metros de alto se distribuyen en el centro y sur de Campeche, norte del Petén, norte de Belice y Quintana Roo y entre las especies vegetales dominantes en estos sitios están el denominado "palo tinte", *H. campechianum*, especie que por mucho tiempo fue explotada para la obtención de tintes, en particular de hematoxilina.

Durante la revisión del material botánico del género *Haematoxylum* en el Herbario Nacional de México (MEXU) para su tratamiento en la Flora Mesoamericana, se detectaron ejemplares de la península de Yucatán con características similares a *H. campechianum*; sin embargo, estas muestras presentan un conjunto de caracteres únicos que hacen que se proponga una especie nueva, la cual se describe a continuación.

Haematoxylum calakmulense Cruz Durán & M. Sousa, sp. nov. TIPO: México. Quintana Roo: Mpio. Othón P. Blanco, camino al poblado de Reforma, 17 mar. 2006 (fl., fr.), *J. Chavelas & M. Chavelas 6276* (holotipo, MEXU; isotipos, FCME, MEXU, MO). Figura 1.

Haematoxylo campechiano L. affine, sed ab eo foliis plerumque brevioribus 6 cm non superantibus, foliolis crassis plerumque magis numerosis ([3- ad]4- ad 5-[ad 6-] jugatis) minoribus (0.7–1.2(–1.5) × 0.4–0.7 cm) subtus trichomatibus albis tantum ad basim prope petiolulum vestitis, venatione secundaria parum manifesta, inflorescentiis plerumque brevioribus (4.5 cm non superantibus) rhachidi floribusque pilosis atque petalis minoribus differt.

Árboles de 3–8(–10) m, o arbustos de 2–6 m, raramente bejucos; tallo acanalado, con 0.25 m diám.; corteza pardo-grisácea que se desprende en placas; ramas con espinas cónicas de 0.5–0.7(–1.5) cm. Hojas 2–5(–6) cm, con (3 a)4 a 5(a 6) pares de folíolos; folíolos 0.7–1.2(–1.5) × 0.4–0.7 cm, obovados a angostamente obovados, crasos, con venación secundaria poco evidente, la base atenuada, el margen entero, el haz glabro, el envés glabro con células epidérmicas protuberantes, piloso solo en la base cerca del peciólulo, el ápice generalmente obtuso a brevemente emarginado; raquis con pelos uncinados blancos; pecíolos (0.3–)0.5–1(–1.5) cm, con abundantes pelos uncinados blancos. Inflorescencias racimos generalmente solitarios, 1.5–4(–4.5) cm, que emergen de braquiblastos cortos; raquis piloso; todos los pedicelos de longitud similar. Flores actinomorfas, blanco-amarillentas, amarillas, blancas o amarillo pálido; brácteas cimbiformes ca. 1 mm; pedicelos ca. 0.4 cm, pilosos; hipantio cupuliforme, piloso, ca. 1 mm; cáliz 3–4 mm, los sépalos oblongos, pilosos externamente; pétalos oblanceolados, 4–5 × 0.15–2 mm; estambres 4 mm, pilosos hasta la parte media; pistilo ca. 6 mm, glabro, el ovario 3 mm, el estilo 3 mm con estigma crateriforme con pelos marginales. Legumbres (2.5–)2.8–3.5(–4) × 0.7–1 cm, fusiformes a oblongas, glabras, con hipantio persistente. Semillas inmaduras.

Distribución y hábitat. A esta especie se le encuentra en vegetación de selva baja sabanoide, selva baja subcaducifolia inundable, selva mediana subperennifolia, selva mediana subcaducifolia alterada y selva baja subperennifolia, en suelo arcilloso, negro húmedo, en elevaciones de 0 a 300 m. En la región Mesoamericana, hasta el momento sólo se le ha localizado en la Península de Yucatán: Guatemala, Belice, y en México, en los estados de Campeche, Yucatán y Quintana Roo.

Categoría de la Lista Roja de UCN/. Datos insuficientes (DD).

Fenología. La especie se encuentra en floración de noviembre a abril y en fructificación de febrero a abril.

Nombre común y usos. En Campeche, México, se le conoce como tinto o tinto bajo; en Yucatán, México, se le denomina palo tinte, tinta, tinta che o bronche, y en Guatemala, tinta. Cabe señalar que en la región los nombres son utilizados de manera indistinta para la especie nueva y para *Haematoxylum campechianum*. La especie nueva se utiliza como maderable y tinte, además de melífera.

Etimología. El epíteto específico hace alusión al sitio donde se han colectado la mayor parte de los ejemplares disponibles de esta especie nueva, el Municipio de Calakmul en el estado de Campeche, México.

Discusión. Esta especie es similar a *Haematoxylum campechianum*; sin embargo, *H. calakmulense* presenta hojas más cortas, no más de 6 cm de largo,

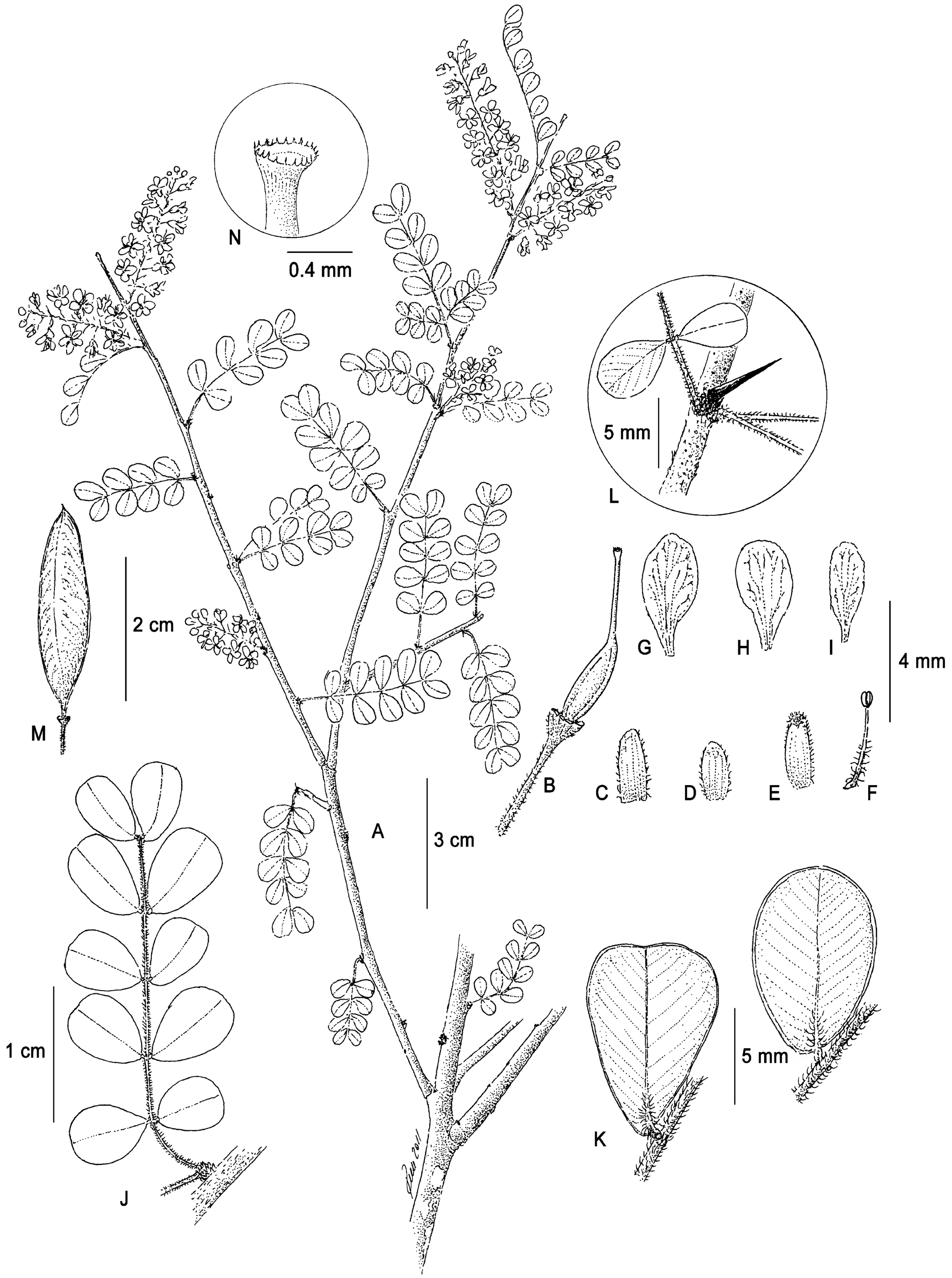


Figura 1. *Haematoxylum calakmulense* Cruz Durán & M. Sousa. —A. Rama con inflorescencias. —B. Pedicelo, hipantio y pistilo. —C. Lóbulo vexilar del cáliz. —D. Lóbulo lateral del cáliz. —E. Lóbulo carinal del cáliz. —F. Estambre. —G. Estandarte. —H. Ala. —I. Pétalo de la quilla. —J. Hoja. —K. Folíolo, envés. —L. Braquiblasto. —M. Fruto. —N. Estigma. A–K, N, *J. Chavelas & M. Chavelas 6276* (MEXU); L, *P. Alvaro & F. Trejo 691* (MEXU); M, *D. Álvarez & C. Jiménez 4223* (MEXU).

Tabla 1. Comparación morfológica, geográfica y fenológica entre *Haematoxylum calakmulense* Cruz Durán & M. Sousa y *H. campechianum* L.

Caracteres	*H. calakmulense*	*H. campechianum*
Árbol, arbusto (tamaño, m)	3–8(−10), 2–6	3–11(−15), 2–4(−7)
Hojas (largo, cm)	2–5(−6)	(3.5–)4–10.5
Raquis y pecíolo, pubescencia	con pelos uncinados blancos	glabros, o en ocasiones con pelos uncinados sólo en la parte adaxial
Folíolos (número de pares)	(3 a)4 a 5(a 6)	(2a)3 a 4(a 5)
Dimensiones (cm)	0.7–1.2(−1.5) × 0.4–0.7	1–3(−3.5) × 0.7–2.7(−3)
Folíolo, ápice	obtuso a emarginado	emarginado a obtuso
Base	atenuada	cuneada
Envés	piloso en la base	glabro
Venación	secundaria poco evidente	secundaria y terciaria evidentes
Inflorescencia (largo, cm)	1.5–4(−4.5)	(3–)3.5–10(−12)
Raquis (pubescencia)	piloso	glabro
Pedicelo y cáliz (pubescencia)	pilosos	glabros, en ocasiones ligeramente pilosos
Pétalos (dimensiones, mm)	4–5 × 0.15–2	6 × 2
Pistilo (largo, mm)	ca. 6	ca. 7
Legumbre (dimensiones, cm)	(2.5–)2.8–3.5(−4) × 0.7–1	3–4.5(−5) × 0.8–1.2
Altitud (m)	0–300	0–240(−400)
Distribución	México (Campeche, Quintana Roo, Yucatán), Belice, Guatemala	México (Campeche, Chiapas, Quintana Roo, Tabasco, Yucatán), Belice, Guatemala
Floración	noviembre–abril	(octubre–)enero–abril
Fructificación	febrero–abril	(enero–)marzo–mayo

pero con mayor número de pares de folíolos, de cuatro a cinco, o hasta seis; en tanto que en *H. campechianum* las hojas pueden alcanzar hasta los 10.5 cm de largo y en general tener de dos a cuatro pares de folíolos, aunque ocasionalmente pudieran presentar cinco. Asimismo, los folíolos en *H. campechianum* son más largos, hasta 3.5 cm, glabros y presentan venación secundaria y terciaria evidentes, mientras que en *H. calakmulense* los folíolos no son más de 1.5 cm de largo y son generalmente de consistencia crasa, además, la venación secundaria es poco evidente, y aunque son glabros en el haz, en el envés son siempre pilosos en la base, cerca de la unión con el peciólulo. En *H. calakmulense* el raquis y el pecíolo siempre tienen pelos uncinados blancos, mientras que en *H. campechianum* generalmente son glabros, aunque en ocasiones pueden presentar pelos uncinados, pero sólo en la parte adaxial. Además, en *H. calakmulense* las inflorescencias son más cortas, no mayores a 4.5 cm, las flores y el raquis son siempre pilosos, los pétalos son de menor tamaño, no más de 5 mm de largo y de tonos blancos a amarillos; por el contrario, en *H. campechianum* las inflorescencias alcanzan hasta los 12 cm de largo, el raquis es glabro, las flores son glabras, los pétalos tienen hasta 6 mm de largo y presentan tonos amarillos (Tabla 1).

Es pertinente señalar que en la península de Yucatán están presentes las dos especies, sin embargo *Haematoxylum campechianum* se distribuye a lo largo de la zona costera y zonas áridas, generalmente hacia la parte norte, mientras que *H. calakmulense* se presenta en el centro y sur de la península, en zonas con alto grado de humedad, en tanto que en la región de Zoh–Laguna ambas especies son simpátricas.

Cabe también mencionar que en el ejemplar *E. Martínez S., D. Álvarez & S. Ramírez 29878* (MEXU) se registra a esta nueva especie como un bejuco con flores blancas, ambos caracteres no registrados con anterioridad para el género.

Clave para las Especies de *Haematoxylum* de África y América Tropical

1a. Ovario piloso; hojas con hasta 3 pares de folíolos; África (Namibia) ..... *H. dinteri*
1b. Ovario glabro a brevemente piloso en el margen; hojas con 2 a 5(a 6) pares de folíolos; América tropical 2
2a. Flores con hipantio cupuliforme, actinomorfas; racimos hasta 12 cm; pedicelos 0.4–0.7 cm, todos de longitud similar, pilosos o glabros; folíolos completamente glabros o pilosos en el envés cerca de la base, con venación secundaria poco evidente o evidente de tercer grado 3
2b. Flores con hipantio cimbiforme, zigomorfas; racimos hasta 5 cm, o panículas de 19 cm; pedicelos (0.5–)0.7–1.3 cm, los de flores basales más largos que los de las flores apicales, pilosos; folíolos glabros o ligeramente pilosos cuando jóvenes, con venación secundaria o evidente de cuarto grado 4
3a. Racimos largos hasta 12 cm, el raquis y las flores glabros; hojas con pecíolo y raquis glabros o solo

pilosos en la parte adaxial; folíolos delgados, 1–3(–3.5) × 0.7–2.7(–3) cm, con evidente venación de tercer grado ..... *H. campechianum*

3b. Racimos cortos hasta 4.5 cm, el raquis y las flores pilosos; hojas con pecíolo y raquis pilosos; folíolos crasos, 0.7–1.2(–1.5) × 0.4–0.7 cm, con venación secundaria poco evidente ..... *H. calakmulense*

4a. Hojas con 2 a 4(a 5) pares de folíolos, en ocasiones la pinna basal bipinnada; folíolos 10–25(–27) × (5–)7–22(–28) mm, obovados a suborbiculares, con evidente venación de cuarto grado, particularmente en el envés, el haz y el envés generalmente glabros o ligeramente pilosos, en particular cerca de la unión con el peciólulo; estigma tubular ..... *H. brasiletto*

4b. Hojas con (3 a)4 a 5 pares de folíolos, o en ocasiones con 3 pinnas basales bipinnadas y 3 pares de folíolos terminales; folíolos (5–)5.5–9(–11) × 2–4(–4.5) mm, oblanceolados, con evidente venación secundaria, el haz y el envés glabros; estigma crateriforme con pelos marginales ..... *H. sousanum*

Paratipos. BELICE. **Distrito Corozal:** Sarteneja 4 km al SE, 18 mar. 1987 (fl.), *G. Davidse & A. Brant 32697* (MEXU). GUATEMALA. **El Petén:** El Petén, camino El Cedro–Río Azul, bajío a la entrada del Río Azul, 20 feb. 2000 (fl.), *M. Peña-Cachorro, J. Tun, N. Bonilla & G. Galicia 843* (MEXU); Tikal, Bajíos de Santa Fe, en alrededores de Aguda Pucte, 3 mar. 1960 (fl.), *C. L. Lundell 16681* (MEXU); Tikal, Parque Nacional, bajío de Santa Fe, 29 ene. 1960 (fl.), *E. Contreras 530* (MEXU). MÉXICO. **Campeche:** Mpio. Calakmul, Narciso Mendoza, 6 km al N, camino a El Manantial, 18°17′0″N, 89°27′6″O, 4 abr. 1998 (fl., fr.), *E. Martínez S., D. Álvarez & B. Sanders 30512* (MEXU); Mpio. Calakmul, 29 km al S de la caseta de entrada a Calakmul, 18°18′13″N, 89°50′59″O, 24 nov. 1997 (fl.), *E. Martínez S., D. Álvarez & S. Ramírez 29878, 29889* (MEXU), 25 nov. 1997 (fl.), *E. Madrid, E. Lira, M. Martínez, D. Álvarez & S. Ramírez 552* (MEXU); 7 km al S de Campamento Talismán, Champotón, 25 mar. 1981 (fl.), *J. Ortíz 103* (MEXU); Mpio. Calakmul, 14 km al O de Nuevo Becal, 18°38′N, 89°24′O, 16 ene. 1997 (fl.), *P. Álvaro & F. Trejo 691* (MEXU); Mpio. Calakmul, 3 km al E del poblado Chichonal, carretera Xpujil–Escárcega, 18°30′57″N, 89°31′42″O, 8 mar. 2003 (fr.), *D. Álvarez & C. Jiménez 4223* (MEXU); 17.4 km sobre el camino a Calakmul, partiendo de la carretera Conhuás–Xpujil, Champotón, 18°23′N, 89°53′O, 13 mar. 1996 (fl.), *J. C. Trejo, I. Olmsted & J. Granados 588* (MEXU); 0.5 km al N de Xpujil, rumbo a Zoh–Laguna, 23 mar. 1982 (fr.), *E. Cabrera & H. de Cabrera 2154* (MEXU); Mpio. Calakmul, 2.9 km al NE de Pioneros del Río, 17°54′14″N, 89°9′6″O, 17 feb. 2002 (fr.), *J. Calónico, E. Martínez & D. Álvarez 21548* (MEXU); Mpio. Calakmul, 4.6 km al NO de El Civalito, 17°54′49″N, 89°19′7″O, 18 mayo 2002 (fl.), *D. Álvarez & J. Calónico 1301* (MEXU); Mpio. Calakmul, 3.5 km al SE de Nueva Vida, 18°46′32″N, 89°21′24″O, 8 mar. 1998, *E. Martínez S., D. Álvarez, D. Nogueira & E. Gamboa 30265* (MEXU); Mpio. Calakmul, 0.5 km al O de 11 de mayo, 18°5′52″N, 89°27′42″O, 17 jul. 1998, *E. Madrid & M. Arandia 1000* (MEXU); Mpio. Calakmul, 1.85 km al N del poblado El Campanario, carretera Xpujil–Justo Sierra, 18°27′53″N, 89°25′32″O, 7 mar. 2002 (fr.), *D. Álvarez & C. Jiménez 4199* (MEXU); Mpio. Calakmul, 8 km al S de Dos Naciones, camino a José María Morelos, "El Civalito", 17°54′49″N, 89°19′7″O, 10 mar. 2002 (fl.), *E. Martínez S., J. Colónico, E. Gamboa & D. Álvarez 35343* (MEXU); Mpio. Calakmul, Calakmul, 10.6 km al NE de Conhuás, 18°36′20″N, 89°51′4″O, 20 feb. 2002 (fl.), *J. Calónico, E. Martínez S. & D. Álvarez 21754* (MEXU); Mpio. Calakmul, 1.3 km al SE del poblado Unión 20 de Junio (antes La Mancolona), 18°48′29″N, 89°16′46″O, 21 Feb. 2003 (fl.), *D. Álvarez, C. Jiménez & J. P. Abascal 4124* (FCME; MEXU); Mpio. Calakmul, 7.4 km al SE de Dos Naciones, 17°54′50″N, 89°19′1″O, 4 feb. 2003 (fl.), *D. Álvarez 3652* (FCME, MEXU); Mpio. Calakmul, a 4.71 km al N de Bel-ha, 18°58′14″N, 89°18′38″O, 2 abr. 2005 (fr.), *D. Álvarez 10723* (FCME, MEXU); Mpio. Calakmul, cerca del poblado Unión 20 de Junio (antes La Mancolona), 18°48′36″N, 89°17′10″O, 24 mar. 2005 (fl., fr.), *E. Martínez S. 37519* (FCME, MEXU); Mpio. Calakmul, poblado La Nueva Vida, 18°48′9″N, 89°21′58″O, 26 mar. 2005 (fl., fr.), *E. Martínez S. 37528* (MEXU); Mpio. Calakmul, a 2.8 km al SE de Conhuás, camino a la zona arquelógica de Calakmul, 18°31′30″N, 89°54′7″O, 8 mar. 2003 (fr.), *D. Álvarez & C. Jiménez 4260* (MEXU); Mpio. Hopelchén, 50 km de Xpujil para la frontera con Guatemala, 18°21′N, 89°26′O, 5 abr. 1982 (fr.), *E. Chan 1304* (MEXU); Mpio. Hopelchén, Zoh–Laguna, 10 km al N de Xpujil, sobre el camino a Dzibalchen, 18°40′N, 89°26′O, 25 ene. 1996, *P. Álvaro 157* (MEXU); Mpio. Hopelchén, Jardín botánico Zoh–Laguna, 10 km al O de Xpujil, camino a Dzibalchen, 18°35′N, 89°25′O, 27 mar. 1991 (fr.), *P. Álvaro 217* (MEXU); Mpio. Campeche, predio ganadero aledaño al camino de terracería que va del Ejido Kikab a Nayarit Castellot, Km. 2, 19°19′N, 90°13′O, 20 dic. 1996 (fl.), *Juárez-Palmillas 565* (MEXU); Mpio. Ciudad del Carmen, 10 km al S de Conhuás, sobre la brecha al centro comercial Calakmul, carretera Escárcega–Chetumal, 27 mar. 1985 (fr.), *E. Cabrera & H. de Cabrera 15997* (MEXU). **Quintana Roo:** Km. 23 Chetumal–Zoh–Laguna, carretera a Quintana Roo, 6 mar. 1958 (fl.), *B. G. Schubert & A. Gómez P. 1705* (MEXU); Carrillo Puerto, 34 km al N, 8 mar. 1980 (fl.), *O. Téllez & E. Cabrera 1769* (MEXU); 15 km al S de San José, rumbo a Tomás Garrido, 17 feb. 1981 (fl.), *E. Cabrera & G. Ibarra 1275* (MEXU). **Yucatán:** Mpio. Valladolid, San Miguel, parte NO de la carretera a 100 m de La Mesura, 20°42′N, 88°14′O, 18 abr. 1983, (fr.), *E. Ucan 2401* (MEXU).

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Manglietia admirabilis (Magnoliaceae), a New Species from Yunnan, China

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ABSTRACT. *Manglietia admirabilis* Y. H. Law & R. Z. Zhou, a new species from Yunnan, China, is described and illustrated. It is closely related to *M. grandis* Hu & W. C. Cheng and *M. dandyi* (Gagnep.) Dandy, having a similar habit and vegetation. *Manglietia admirabilis* differs in its prominently lenticellate branches. Its leaves are dark green, abaxially ferrugineous pubescent, and are relatively small in size (16–24 × 9–10 cm). The new species is distinguished by its combination of white tepals, red stigmas, red and glabrous stamens, and relatively few carpels (28 to 40).

Key words: China, Magnoliaceae, *Manglietia*, IUCN Red List, Yunnan.

Manglietia Blume (Magnoliaceae) is regarded as a primitive group within the Magnoliaceae, and the genus comprises ca. 30 species that mainly occur in tropical and subtropical Asia (Law, 1984, 1996, 2004; Nooteboom, 1985, 1987; Chen & Nooteboom, 1993; Law et al., 1995; Zeng & Law, 2004; Zeng et al., 2007; Xia et al., 2008). More than 27 species of *Manglietia* are found in southern and southwestern China, with the taxonomic center of diversity in Yunnan, Guangxi, and Guangdong provinces (Law, 2004; Zeng & Law, 2004; Zeng et al., 2007).

Since the 1980s, researchers have been conducting detailed surveys of the Magnoliaceae across China. During an expedition to Gulinqing in Yunnan Province, we collected a specimen of *Manglietia* from which living plants were subsequently collected. These were then cultivated toward their conservation in the magnolia garden at the South China Botanical Garden. After we studied material of this taxon, it was definitely clear that this could not be placed in any of the previously described taxa within *Manglietia*, and thus it is validated herein as new. This taxon was previously described in *Magnolias of China* (Law, 2004), but no Latin diagnosis was provided and no type was specified, as required by Articles 36.1 and 37.1 of the International Code of Botanical Nomenclature (McNeill et al., 2006), and the name was invalidly published at that time.

Manglietia admirabilis Y. H. Law & R. Z. Zhou, sp. nov. TYPE: China. Yunnan: Maguan Co., Gulinqing, limestone montane evergreen broad-leaved forests, ca. 1300 m, 12 May 1986, *Zhou Renzhang 98* (holotype, IBSC). Figure 1.

Species nova *Manglietiae grandi* Hu et W. C. Cheng et *M. dandyi* (Gagnep.) Dandy affinis, sed a hac foliis minoribus abaxiliter parce ferrugineo-pubescentibus; ab illa stipulorum cicatricibus 1.2–1.4 cm longis atque staminibus rubris; ab ambabus ramulis cinereo-brunneis lenticellis albis praeditis, tepalis albis atque carpellis usque 28 ad 40 differt.

Evergreen trees to 20 m tall, 30 cm DBH; bark coarse, grayish brown, longitudinally furrowed; young twigs light green, stout, ferrugineous tomentose, with white prominent lenticels, old ones grayish brown; buds conical, 3–4 cm, ferrugineous villose. Leaves leathery, elliptic or obovate to elliptic, 16–24 × 9–10 cm, apex obtuse or briefly acute, base widely cuneate, adaxially dark green, pubescent matte, abaxially sparsely ferrugineous tomentose; midribs elevated adaxially, with secondary veins 16 to 22 on each side; petioles 2.5–3 cm; stipular scars 1.2–1.4 cm, 1/2 as long as the petioles; stipules caducous. Peduncles green, ferrugineous tomentose. Flowers fragrant, tepals 9 to 12 in total number, fleshy, white, the outer 3 tepals obovate-oblong or elliptic, 6–7 × 3–4 cm, with 5 or 6 longitudinal veins, the inner tepals obovate to spathulate, smaller in size than the outer 3 tepals; androecium red, glabrous; gynoecium 1.5–3 cm, pale yellowish green, ovoid; styles red, glabrous; stigmas red; ovaries unicarpellate, with 28 to 40 carpels per synflorescence; carpels introrsely furrowed, 4- to 6-ovulate in 2 series. Fruit aggregates not observed, abortive during development in wild.

Distribution and habitat. *Manglietia admirabilis* was found in limestone evergreen broad-leaved forests at elevations of 800–1500 m in Gulinqing,

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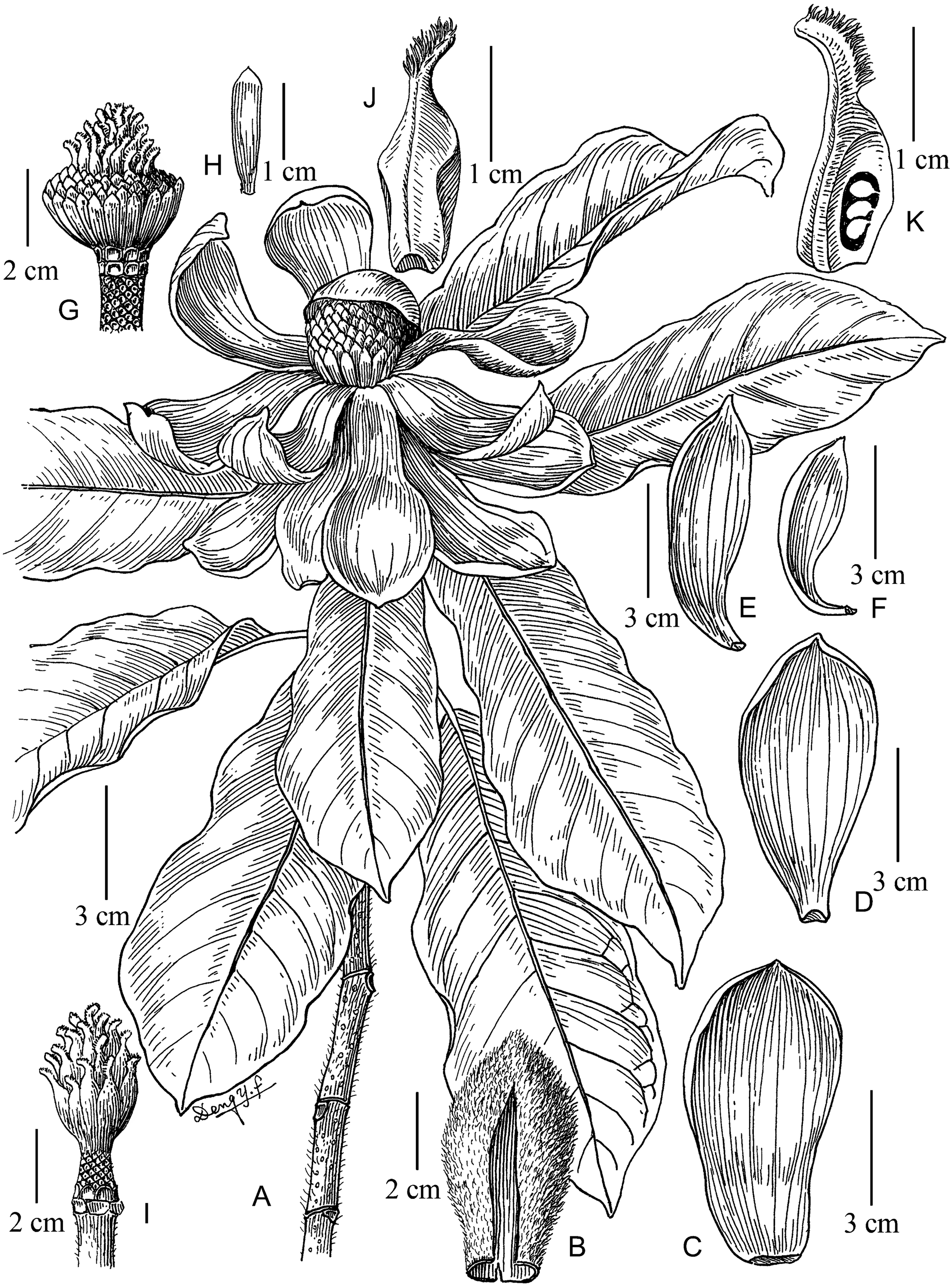


Figure 1. *Manglietia admirabilis* Y. H. Law & R. Z. Zhou. —A. Fertile branch. —B. Spathe. —C. Outer tepal. —D. Middle tepal. —E. Inner tepal. —F. Inner tepal. —G. Gynoecium subtended by androecium below. —H. Individual stamen dissected from androecium. —I. Gynoecium, with stamens below removed. —J. Individual gynoecium dissected from synflorescence. —K. Longitudinal section through carpel of single gynoecium removed from synflorescence. Illustrated from the holotype *Zhou Renzhang 98* (IBSC).

Table 1. Morphological comparison of the new species *Manglietia admirabilis* Y. H. Law & R. Z. Zhou, with the similar species *M. grandis* Hu & W. C. Cheng and *M. dandyi* (Gagnep.) Dandy.

Characters	*M. admirabilis*	*M. grandis*	*M. dandyi*
Buds	conical, 3–4 cm, ferrugineous villose	conical, ca. 4 cm, glabrous, glaucous	conical, ca. 3–4 cm, covered with densely long ferrugineous tomentum
Young branches	ferrugineous tomentose, with white prominent lenticels, grayish brown with age	glaucous, pale gray with age, glabrate	densely long ferrugineous tomentose, older branches tomentose
Leaves	16–24 × 9–10 cm, blades elliptic or obovate to elliptic, adaxially pubescent matte, dark green, abaxially sparsely ferrugineous tomentose, apex obtuse or briefly acute, base widely cuneate	20–35 × 10–13 cm, blades elliptic or obovate-oblong, adaxially glabrous, glossy, light green, abaxially densely papillose, apex acute to cuspidate, base broadly cuneate	25–50 × 10–20 cm, blades obovate, basal ca. 2/3 narrowed, adaxially glabrous, abaxially matte, ferrugineous densely long tomentose, apex acute, base cuneate
Secondary venation on leaf blades	16 to 22 per side	17 to 26 per side	20 to 22 per side
Petioles	2.5–3 cm	2.6–4 cm	2–3 cm
Stipule scars	1.2–1.4 cm, 1/2 as long as petioles	0.65–1 cm, 1/4 as long as petioles	0.7–2 cm, 1/3 to 2/3 as long as petioles
Peduncles	green, ferrugineous tomentose	green, glabrous	green, densely long ferrugineous tomentose
Tepals	tepals 9 to 12, fleshy, with 3 outer tepals thinner; tepals 6–7 × 3–4 cm, white, obovate to oblong or elliptic	tepals 12, with 3 outer tepals thinner; tepals 9–11× 5–7 cm, pale red, obovate-oblong	tepals 9 to 10, with 3 outer tepals thicker, 4.5–5 × 2.5–2.8 cm, pale green, obovate-oblong
Stamens	red, glabrous	white, pubescence	red, villous
Gynoecia	ovoid, pale yellowish green, glabrous; styles red, 1.5–3 cm	ovoid, pale yellowish green, pubescence; styles red, ca. 4 cm	ovoid, white, glabrous; styles white, 2.5–3 cm
Carpels	28 to 40 per synflorescence; carpels introrsely furrowed	55 to 75 per synflorescence; carpels not furrowed, but with abaxial midvein concave to apex of style	60 to 75 per synflorescence; carpels extrorsely slightly curved
Ovules	4 to 6	4 to 12	6 to 12
Stigmas	red	white	red
Distributions by county (province)	Maguan (Yunnan)	Jingxi and Napo (Guangxi), Xichou and Malipo (Yunnan)	Jingxi (Guangxi), Xichou (Yunnan)

Maguan County, in southeastern Yunnan, China. *Manglietia admirabilis* appears to be endemic and is only known from the type locality at Chuntianping, with a small population estimated at 50 trees in the wild. Only two cultivated trees are maintained at South China Botanical Garden (SCBG) in Guangdong. This is in contrast to the broader distributions of *M. grandis* Hu & W. C. Cheng and *M. dandyi* (Gagnep.) Dandy. *Manglietia grandis* is distributed in Jingxi and Napo counties in Guangxi Province and Xichou and Malipo counties in Yunnan Province, while *M. dandyi* is distributed in Jingxi County in Guangxi Province and Xichou County in Yunnan Province.

IUCN Red List category. So far, *Manglietia admirabilis* is only known from one locality, with a small population estimated at 50 trees. No seedlings and young trees were observed around mature individuals of *M. admirabilis* in the wild during the latest investigation in 2010. The taxon could be considered an excellent garden plant for its attractive large, white flowers, and the trees are now under cultivation at SCBG. They have survived under cultivation, but do not grow very well, and no fruits have been seen in over 28 years of cultivation. Thus we assess this species as CR, or Critically Endangered, according to IUCN (2001) conservation criteria.

Phenology. *Manglietia admirabilis* was observed in flower from April to May, but the fruit was not observed in the wild. In 1986, eight young trees were introduced to SCBG, but only two have survived thus far. They do not grow very well, and no flowers or fruit have been seen in over 28 years of cultivation; no fruit aggregates have been seen, either in the wild or under cultivation at SCBG.

Relationships. *Manglietia admirabilis* was found growing only in monsoonal, evergreen broad-leaved forests at 800–1500 m, in Maguan County in Yunnan Province. It is closely related to *M. grandis* and was previously identified as similar to *M. dandyi*, which also included *M. megaphylla* Hu & W. C. Cheng, in the recent *Flora of China* treatment (Xia et al., 2008). However, the buds of *M. admirabilis* are ferrugineous villose, which contrasts with the densely long ferrugineous tomentum seen in *M. dandyi*. Its twigs are grayish brown with white lenticels, which neither *M. grandis* nor *M. dandyi* have. The new species has small leaves, 16–24 × 9–10 cm, compared to leaf dimensions of 20–35 × 10–13 cm in *M. grandis* and 25–50 × 10–20 cm in *M. dandyi*. Leaves of *M. admirabilis* are dark green and glaucous adaxially and sparsely ferrugineous pubescent abaxially. This contrasts with the densely papillose leaves seen in *M. grandis* and blades that are densely long ferrugineous tomentose in *M. dandyi*. Comparatively, the stipule scars are 1.2–1.4 cm long in *M. admirabilis* (vs. 0.65–1 cm in *M. grandis* and 0.7–2 cm in *M. dandyi*). The flowers of the new species have white tepals (vs. red in *M. grandis* and pale green in *M. dandyi*), and its stamens are red (vs. white in *M. grandis* and red in *M. dandyi*). Gynoecia are short in *M. admirabilis*, 1.5–3 cm long, compared to 4 cm in *M. grandis* and 2.5–3 cm in *M. dandyi*. Stigmas are red, and the carpel number is the fewest in *M. admirabilis*, with only four to six ovules per carpel (vs. four to 12 in *M. grandis* and six to 12 in *M. dandyi*). A detailed comparison of morphological characteristics among the three species is given in Table 1.

Paratype. China. **Guangzhou:** Magnolia garden of South China Botanical Garden, ca. 50 m, 3 May 2011, *Fulin 20110503* (IBSC).

Acknowledgments. This work was supported by the National Natural Science Foundation of China (grants 31100233 and 31070305), the science and technology project of Guangdong Province (grant 2011B02030200), and the Youth Foundation of Key Laboratory of Plant Resources Conservation and Sustainable Utilization, Chinese Academy of Sciences (211013). We sincerely thank Mr. Zhu Kaifu, the Board Chairman of Shenzhou Magnolia Garden and Breeding Center, for greatly sponsoring our research. We also thank Mr. Deng Yingfeng for the illustration of *Manglietia admirabilis*.

This article is dedicated to the memory of our co-author Zeng Qingwen (1963–2012), who lost his life 20 September 2012, in a fall from a 40-m research platform in a remote area of Xichou County near Fadou Town in southeastern Yunnan Province. Prof. Zeng was a well-known Magnoliaceae expert and researcher. He had long been engaged in all aspects of the studies of Magnoliaceae. We will miss him forever.

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Two New Species of *Tibouchina* (Melastomataceae) from Brazil

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Abstract. *Tibouchina bruniana* P. J. F. Guim. and *T. araguaiensis* P. J. F. Guim., two new species from Goiás and Tocantins, respectively, in central Brazil, are described, illustrated, and compared to their putative closest relatives. Both new species belong to *Tibouchina* sect. *Barbigerae* Naudin, which is characterized by long, simple trichomes on the anthers, positioned over the union between the staminal filament and connective. *Tibouchina bruniana* can be distinguished by its solitary flowers, less often in dichasia, and the diagnostic characters of *T. araguaiensis* presents as ciliate and overlapping triangular hypanthial scales.

Key words: Central Brazil, Goiás, IUCN Red List, Melastomataceae, *Tibouchina*, Tocantins.

Tibouchina Aubl. is the largest Neotropical genus of the Melastomeae sensu Renner (Melastomataceae) and is distributed from Mexico and the Caribbean to northeastern Argentina and Paraguay (Todzia & Almeda, 1991). Within this genus, ca. 460 species and varieties have been validly published to date (Tropicos, 2013). The genus was first described by Aublet (1775) from French Guiana and encompassed one species, *T. aspera* Aubl. With its distinctive floral features and restricted geographic distribution in northwest South America, *T. aspera* was subsequently transferred to *Melastoma* L. by D. Don (1823); on the other hand *Tibouchina* was treated as a monotypic genus by de Candolle (1828) and Chamisso (1834). *Tibouchina* currently includes species originally described in *Chaetogastra* DC., *Diplostegium* D. Don, *Lasiandra* DC., *Pleroma* D. Don, and *Purpurella* Naudin as established by Cogniaux (1885). A recent molecular phylogenetic analysis of the tribe Melastomeae demonstrated that *Tibouchina* is polyphyletic (Guimarães et al., 2010; Michelangeli et al., 2013). Species of *Tibouchina* fall into four different clades that are well supported by molecular evidence (nuclear and chloroplast sequences) and morphological data as well as geographic distribution. The results support the recognition of *Pleroma* and *Chaetogastra*, previously synonymized under *Tibouchina*. The phylogeny of Neotropical Melastomeae, which includes *Tibouchina*, *Pleroma*, and *Chaetogastra*, is in the process of being completed and will include the pertinent taxonomic transfers (P. J. F. Guimarães & F. A. Michelangeli, unpubl. data). Species of *Tibouchina* s. str. are characterized by the presence of scalelike trichomes that cover the leaves and hypanthium and lilac anthers with a long pedoconnective. The group is restricted to savanna habitats and comprises those species of *Tibouchina* currently placed in *Tibouchina* sect. *Tibouchina* Aubl. and *Tibouchina* sect. *Barbigerae* Naudin.

1. Tibouchina bruniana P. J. F. Guim., sp. nov. TYPE: Brazil. Goiás: Niquelândia, próximo ao povoado de Macedo, ca. 7 km da Mina de Níquel Tocantins, do lado esquerdo passando por baixo do teleférico, 14°18′59″S, 48°23′34″W, 20 Sep. 1996, *M. Aparecida Silva, M. L. Fonseca, E. C. Lopes & C. C. S. Ferreira 3172* (holotype, IBGE; isotype, UB). Figure 1.

Haec species *Tibouchinae melastomoidi* (Naudin) Cogn. hypanthii squamis similis, sed ab ea caulibus ramosis, floribus solitariis vel in dichasia dispositis et petalis lilacinis vel pallide purpureis differt.

Shrub ca. 1.5 m tall; branches quadrangular, strigose, densely covered with lanceolate, short ciliate appressed scales attached by the base, the scales also covering the petiole and primary veins on the abaxial blade surface. Leaves with the petiole 2–4 mm, blade 1.4–2.5 × 0.8–1.3 cm, oblong to lanceolate, apex acute, base obtuse, margin entire, adaxial leaf surface lepidote, with flattened scales, 0.6–1.3 mm long, scales adnate for 3/4 their length, the distal quarter of the scale is free and triangular with a short ciliate margin, the adnate portion covered with minute visible granulations, druses; abaxial leaf surface with adnate scales with ciliate margin 0.5–1 mm long, 5-nerved, intramarginal veins occasionally converging above the leaf base. Flowers terminal, solitary or in dichasia, bracteoles 2, ca. 7.5 × 2 mm, similar to the leaves in shape and indumentum, flat, lanceolate, apex acute, margin not ciliate, caducous after anthesis. Flowers 5-merous, pedicellate, pedicels ca. 2 mm; hypanthium 7–8 × 4–5 mm, tubular, strigose, scales 0.8–1.5 mm, short ciliate with minute glandular hairs, and larger scales between the calyx lobes ca. 2.8 mm; calyx lobes 5–6 × 2–2.5 mm, oblong to lanceolate, apex acute, margin ciliate, outer

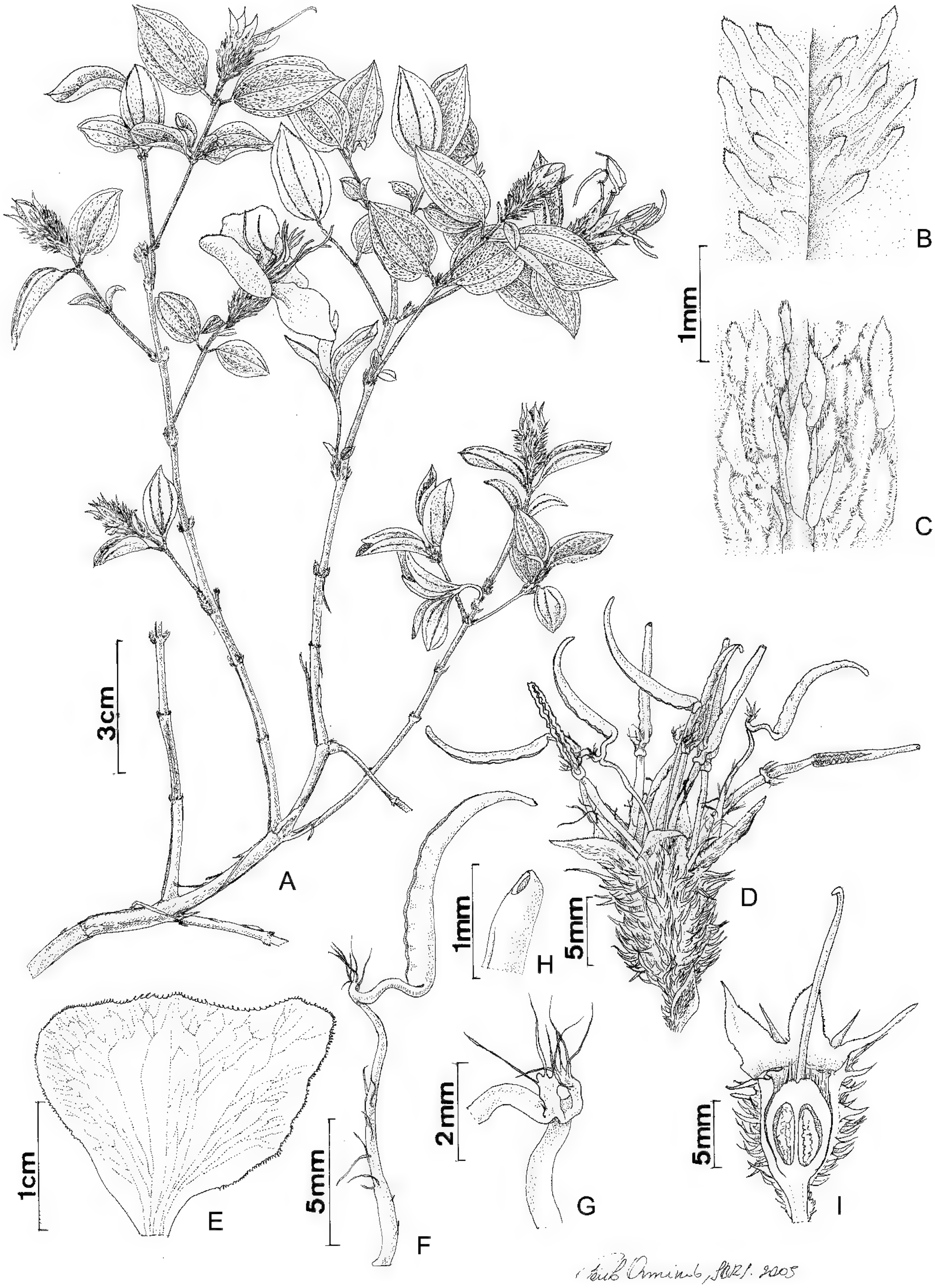


Figure 1. *Tibouchina bruniana* P. J. F. Guim. —A. Fertile habit. —B. Detail of adaxial leaf surface, showing the flattened scales. —C. Detail of abaxial leaf surface, revealing the ciliate scales partially adnate to blade surface. —D. Anthesal flower, with the petals removed to reveal stamens and style, the scaly hypanthium evident with a small bracteole at the base. —E. Petal showing venation. —F. Lateral view of intact stamen. —G. Staminal connective appendages. —H. Anther apex. —I. Pistil, longitudinal cross section. Drawn from the paratype *T. S. Filgueiras et al. 3070* (IBGE).

surface strigose with the scales concentrated in the central portion of the blade; petals lilac or purple, ca. 2 × 2.2 cm, obovate, apex truncate, margin glandular-ciliate; stamens 10, slightly dimorphic in size, filaments with few non-glandular hairs, anthers subulate, apex attenuate, connectives with a cluster of long filamentous hairs on two ventral appendages, filaments ca. 9 mm, anthers ca. 9 mm and connectives prolonged ca. 2 mm below the thecae; ovary superior, 5-locular, apical portion densely sericeous, style ca. 15 mm, filiform, glabrous, stigma truncate. Mature capsules not seen.

Distribution and habitat. *Tibouchina bruniana* is found in Niquelândia, Goiás State, Brazil, at elevations ca. 1100 m. The new species was observed to grow in cerrado vegetation with compacted soil ("Solo compacto. Campo sujo."), as well as in swampy areas.

IUCN Red List category. Recent efforts to recollect *Tibouchina bruniana* were made in March 2012 and were unsuccessful. It was not possible to find specimens, either vegetative or fertile. However, the road along which the type material was collected was blocked, and the vegetation is in process of regeneration. The road blockade started 7 km before the previous collecting locality. Although the only known population of this species was located next to a nickel mine, we have very little information about its distribution and are unable to assign this taxon into a category of high risk of extinction. Therefore, *T. bruniana* is assessed as Data Deficient (DD), according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet honors Sérgio de Almeida Bruni, president of the Rio de Janeiro Botanical Garden over two periods, the first during the 1980s and the second term from 1995 to 2003. During his administration he promoted great advances at the Garden, such as the establishment of the Atlantic Forest Program and the opening of the National School of Tropical Botany with its graduate program.

Discussion. *Tibouchina bruniana* is distinctive by its solitary flowers sometimes arranged in a dichasium, a feature that has no precedent among species of *Tibouchina* sect. *Barbigerae*. Other unusual characteristics of *T. bruniana* are the small leaves (to 2.5 cm long) and a hypanthium with strigose indument with short ciliate scales. These characteristics of a solitary flower and the reduced leaf size are so strongly distinctive that it is difficult to align this species with related ones. The hypanthial indument does suggest a relationship with *T. melastomoides* (Naudin) Cogn., but in this species the unbranched stems have terminal short and congested inflorescences of more than two flowers and are dark purple in color (vs. branched stems and solitary or paired flowers, lilac or pale purple in color). *Tibouchina bruniana* is assigned to *Tibouchina* sect. *Barbigerae* on the basis of the long, simple trichomes on the anthers positioned over the union between the staminal filament and connective.

Paratypes. BRAZIL. **Goiás:** Niquelândia, ca. 15 km of Macedo, 8 Nov. 1994, *T. S. Filgueiras, M. L. Fonseca & J. H. Kirkbride 3070* (IBGE); id., Usina de Níquel Tocantins, estrada à direita da mina a 8 km desta, 18 Dec. 1996, *R. Marquete, A. Vaz, R. C. Mendonça, M. L. Fonseca & G. N. Jesus 2637* (RB).

2. Tibouchina araguaiensis P. J. F. Guim., sp. nov. TYPE: Brazil. Tocantins: Pium, Parque Nac. Araguaia, ponta da ilha, rio Javaés, 195 m.s.m., 9°51′43″S, 50°10′35″W, 28 Mar. 1999, *R. C. Mendonça, M. Aparecida da Silva, E. Cardoso, N. R. Oliveira & N. Goulart Souza 4083* (holotype, IBGE; isotype, FLOR). Figure 2.

Species nova *Tibouchinae papyro* (Pohl) Toledo foliis adaxialiter squamis applanatis lepidotis similis, sed ab ea foliis abaxialiter squamis inconspicue ciliatis sparsim vestitis et hypanthii squamis triangularibus ciliatis differt.

Shrub ca. 3 m tall, branches terete to quadrangular, densely covered with appressed, lanceolate scales attached by the base, with the lepidote indument also on the petiole and primary veins on the abaxial leaf surface. Leaves with petiole 7–9 mm; blades 5–6 × 2.3–3 cm, elliptic, apex obtuse, base obtuse, margin entire, adaxial leaf surface lepidote with flattened scales, 0.7–1.5 mm long, adnate for 2/3 their length, the distal third of the scale free and triangular, the linear adnate portion covered with minute visible granulations, druses; abaxial leaf surface sparsely covered with adnate triangular scales with inconspicuous ciliate margin, ca. 0.3 mm, 3-nerved with a smaller pair of veins just inside the leaf margin, all converging at the base. Thyrse terminal, 7–9 cm, with 7 to 9 flowers, bracteoles 2, ca. 9 × 6 mm, caducous after anthesis, concave, apex obtuse, margin ciliate, outer surface with adnate triangular scales with inconspicuous ciliate margin, flowers 5-merous, pedicellate, pedicel ca. 2 mm. Hypanthium 9–10 × 8 mm, campanulate, densely covered with adnate triangular scales with ciliate margin that overlap one another, ca. 0.5 mm long, larger scales between the calyx lobes ca. 1 mm long; calyx lobes ca. 5 × 5 mm, orbicular, apex obtuse, outer surface of indument similar to that of the hypanthium, calyx margin ciliate; petals light purple, ca. 3 × 2.5 cm, obcordate, apex asymmetrically retuse, margin ciliate; stamens

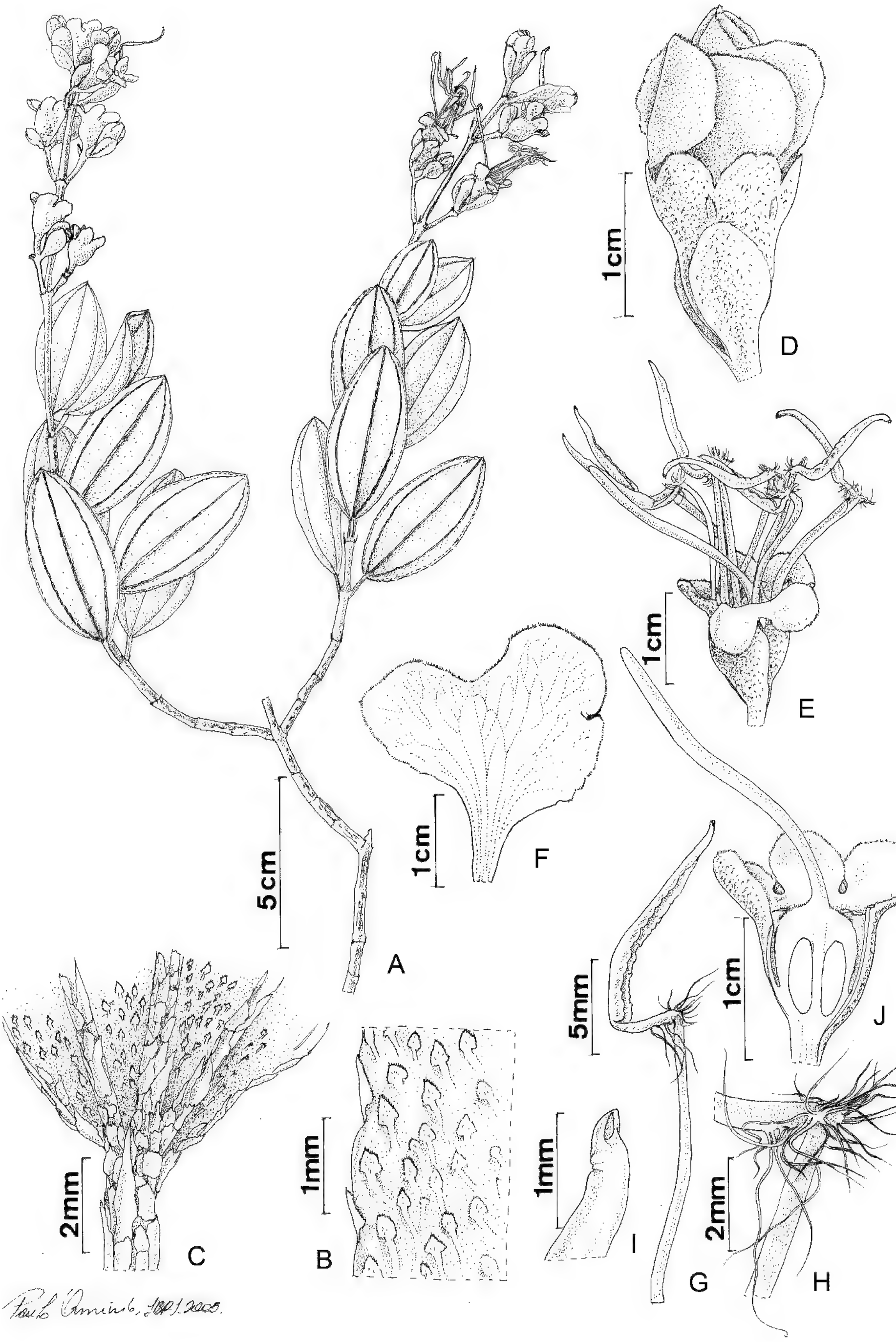


Figure 2. *Tibouchina araguaiensis* P. J. F. Guim. —A. Fertile habit. —B. Detail of adaxial leaf surface, showing the flattened scales adnate for 2/3 length. —C. Detail of abaxial leaf surface and petiole, revealing the partially adnate, flattened scales and the basal origin of the three primary veins. —D. Flower bud with pair of basal bracteoles evident. —E. Anthesal flower with petals removed. —F. Petal showing venation and clawed base. —G. Intact stamen, longitudinal view. —H. Close-up of staminal connective near the union with the stamen showing the clustered, long filamentous hairs. —I. Close-up of anther apex with ventrally inclined pore. —J. Pistil shown in longitudinal cross section. Drawn from the type *R. C. Mendonça et al. 4083* (IBGE).

10, subisomorphic, filaments glabrous, anthers subulate, apex attenuate, connectives with a cluster of long filamentous hairs on short ventral appendage; antipetalous stamens, with filaments ca. 11 mm, anthers ca. 8 mm and connectives prolonged ca. 2 mm below the thecae; antisepalous stamens with filaments ca. 13 mm, anthers ca. 11 mm and connectives prolonged 3 mm below the thecae; ovary half-inferior, 5-locular, the free apical portion densely sericeous, style 2–2.5 cm, filiform, glabrous, stigma truncate. Mature capsules not seen.

Distribution and habitat. *Tibouchina araguaiensis* was collected in Araguaia National Park, Pium, Tocantins State, Brazil, at ca. 200 m elevation. This species inhabits a transitional area between forest and meadows, with sandy soil and flat relief ("transição entre mata e varjão, solo arenoso e relevo plano").

IUCN Red List category. Although *Tibouchina araguaiensis* was collected in an area of environmental protection, I do not have sufficient information about its distribution to determine its conservation status. Therefore, *T. araguaiensis* is assessed as Data Deficient (DD), according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet "araguaiensis" refers to Araguaia National Park, where this species was originally collected.

Discussion. The diagnostic characters of *Tibouchina araguaiensis* present as overlapping, triangular hypanthial scales with a ciliate margin. The total covering of the hypanthium is unique within *Tibouchina* sect. *Barbigerae*.

Tibouchina araguaiensis closely resembles *T. papyrus* (Pohl) Toledo on the basis of its adaxial leaf indument with flattened scales ca. 1 mm long and 3/4 adnate to the surface (vs. to 1.5 mm long and adnate for 2/3 scale length in the new species). These scales, on the upper leaf blade surfaces of *T. papyrus*, are similar to those in *T. araguaiensis* except for the adnate part of the scale, which is larger in the new species. Both species also share similar scales with a ciliate margin on the hypanthium, but the scales in *T. papyrus* are lanceolate, and in *T. araguaiensis* they are triangular. The lower leaf surface is useful in distinguishing the two species. *Tibouchina papyrus* has prominently ciliate scales that cover the entire abaxial leaf surface. In contrast, *T. araguaiensis* has inconspicuously ciliate scales sparsely covering the lower leaf surface. *Tibouchina papyrus* is endemic to three localities in cerrado rupestre from central Brazil: Serra de Natividade in southeast Tocantins and Serra Dourada and Serra dos Pirineus in western Goiás (Telles et al., 2011) (vs. flat topography registered in Araguaia National Park located in southwest Tocantins).

Tibouchina araguaiensis is assigned to *Tibouchina* sect. *Barbigerae* on the basis of the staminal morphology.

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Barbula satoi (Pottiaceae, Bryopsida), a New Combination from China and Notes on the Circumscription of *Sinocalliergon*

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Abstract. The taxonomic position of *Sinocalliergon* Sakurai (originally described in the Amblystegiaceae) is re-evaluated, based on examination of the type specimens. The monotypic genus is considered synonymous with *Barbula* Hedw. (Pottiaceae, Bryopsida), and the appropriate new combination, *B. satoi* (Sakurai) S. He, is made. The name *S. satoi* Sakurai is lectotypified.

Key words: Amblystegiaceae, aquatic moss, *Barbula*, China, *Hydrogonium*, *Sinocalliergon*.

The monotypic genus *Sinocalliergon* Sakurai was established in the Amblystegiaceae by Sakurai (1949), yet taxonomic information on this Chinese endemic taxon has been limited to the type protologue. The genus has been completely overlooked in all recent Chinese moss floras, except for its mention in a checklist of Chinese mosses (Redfearn et al., 1996). Chen et al. (1978) made no reference of *Sinocalliergon* in the work *Genera Muscorum Sinicorum*, and the genus was not treated in *Flora Bryophytorum Sinicorum* (Hu & Wang, 2005) nor in the *Moss Flora of China* (English version) series (Wu et al., 2008). Apparently based on misinformation, Wu (1992: 108) stated that "the type of *Sinocalliergon satoi* Sakurai was destroyed in Japan during the Second World War." However, Sakurai's original referenced material, along with two syntypes for the species, was deposited in Makino Herbarium at Tokyo Metropolitan University. Recently, I was able to do a thorough study of the morphology of the type specimens of *S. satoi*. This paper provides a taxonomic re-evaluation of the genus and presents a detailed description and illustrations of the species.

The original type material of *Sinocalliergon* was collected in an aquatic habitat from Shanxi Province, North China. Two sterile specimens were made in the same locality by Sato Masami during his extensive collecting trip to that province. Gametophytically, the genus is characterized primarily by the lingulate-lanceolate leaves that have a strong, nearly percurrent single costa and the quadrate to hexagonal median and upper leaf cells. When originally described by Sakurai (1949), the genus was compared to *Calliergon* (Sull.) Kindb., also in the Amblystegiaceae. Clearly, the author considered it to be a pleurocarpous moss based on limited features. Interestingly, this aquatic moss shows an internal costal structure differentiation in cross section with a row of guide cells and two stereid bands. Such a feature has never been seen in any species of the Amblystegiaceae nor in any pleurocarpous moss families with a strong, single costa. This peculiar character suggests a relationship to acrocarpous mosses. The overall leaf aerolation and the scarcely branching stems further indicate that *S. satoi* is not a pleurocarpous moss, but belongs to an acrocarpous family, the Pottiaceae.

Judging from a combination of the characters, such as the lingulate-lanceolate to narrowly oblong or lanceolate leaves, the strong, percurrent single costa with two stereid bands, the quadrate or quadrate-hexagonal median and upper leaf cells that are smooth, and the elongate, thin-walled basal leaf cells, I am convinced that this aquatic moss is most closely related to the genus *Barbula* Hedw. (Pottiaceae). Hence, a new combination is made for *Sinocalliergon satoi*, which transfers the only species and synonymizes the genus within *Barbula*.

Barbula Hedw., Sp. Musc. Frond. 115. 1801. TYPE: *Barbula unguiculata* Hedw., lectotype designated by Steere in Grout (1938: 175). [Moss Fl. N. Am. 1.]

Sinocalliergon Sakurai, Bot. Mag. (Tokyo) 62: 108. 1949, syn. nov. TYPE: *Sinocalliergon satoi* Sakurai.

Barbula satoi (Sakurai) S. He, comb. nov. Basionym: *Sinocalliergon satoi* Sakurai, Bot. Mag. (Tokyo) 62: 108. fig. 11. 1949. TYPE: China. Shanxi: Ping-ding Co., Niangziguan, 1 May 1942, *Masami 24* (lectotype, designated here, MAK). Figures 1, 2.

Plants medium-sized to rather large, soft, green above, yellowish green below, dull, in dense tufts; stems up to 7 cm long, sometimes scarcely branched above, densely foliate; leafy stems ca. 2 mm wide; with 1 to 2 rows of smaller, thicker-walled epidermal cells and 4 to 5 rows of larger, thin-walled medullar cells in cross section; a central strand present;

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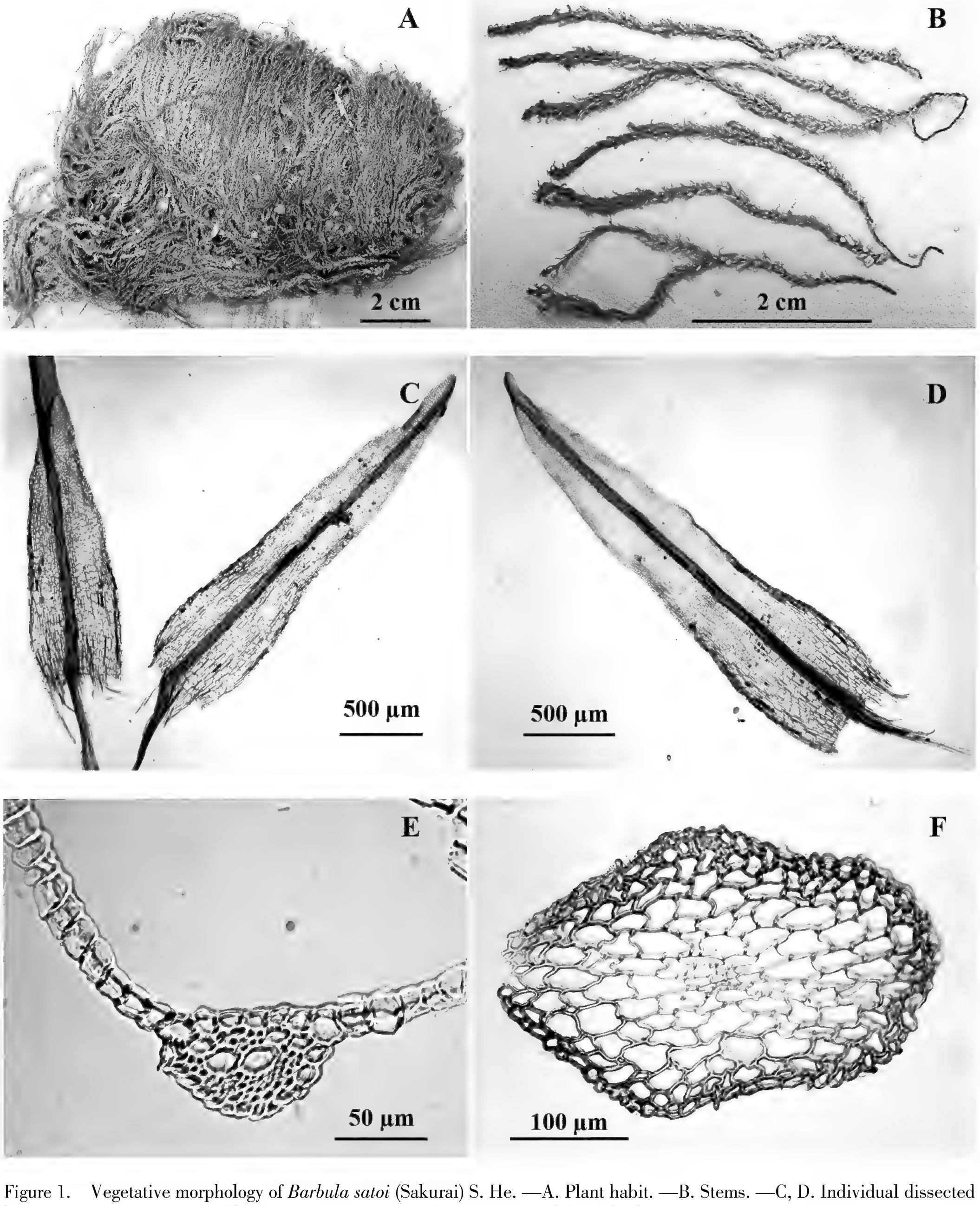


Figure 1. Vegetative morphology of *Barbula satoi* (Sakurai) S. He. —A. Plant habit. —B. Stems. —C, D. Individual dissected leaves. —E. Cross section of leaf. —F. Cross section of stem. Prepared from the lectotype *Masami 24* (MAK).

pseudoparaphyllia absent. Leaves flaccid, somewhat loosely contorted when dry, erect-spreading when moist, ± undulate, lingulate-lanceolate, narrowly oblong-lanceolate, 2.5–3 × 0.4–0.6 mm, narrowly obtuse, usually blunt at the apex, ± decurrent at the base; margins entire throughout, slightly recurved below mid-leaf; costae single, strong, thick, ca. 75 µm wide, reaching near the apex or percurrent, with a row of guide cells and 2 stereid bands in cross section, cells of adaxial surface of costa short-oblong to rectangular, smooth, thin-walled; median and upper leaf cells quadrate to quadrate-hexagonal or short-rectangular, 10–12 × 10–18 µm, always smooth, pellucid; basal leaf cells elongate-rectangular, 60–100 × 13–15 µm, lax, thin-walled; alar cells hardly

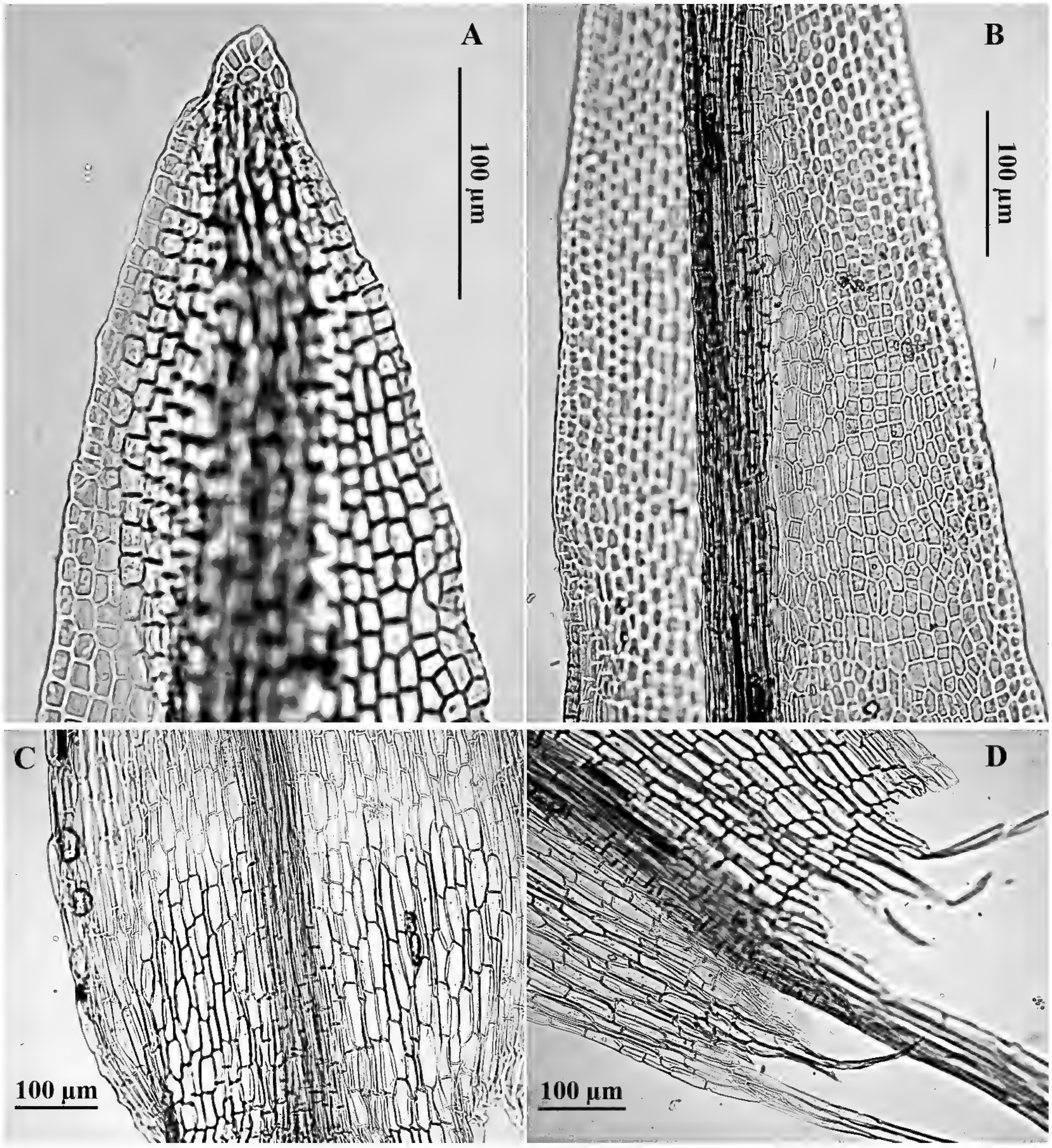


Figure 2. Leaf cells of *Barbula satoi* (Sakurai) S. He. —A. Apical leaf cells. —B. Median leaf cells. —C, D. Basal leaf cells. Prepared from the lectotype *Masami 24* (MAK).

differentiated. Brood bodies absent. Sporophytes not seen.

The two type specimens from MAK are both marked as syntypes on the labels. Lectotypification of *Masami 24* was designated over the other collection, *Masami 25*, because the former is in better condition and has more material than the latter.

Discussion. Aside from its aquatic habitat, *Barbula satoi* is best characterized by the quadrate or quadrate-hexagonal median and upper leaf cells that are always smooth, the elongate-rectangular basal leaf cells that are thin-walled and lax, and the often decurrent leaf bases. It is similar to *B. ehrenbergii* (Lorentz) M. Fleisch. in that it is a soft plant, with blunt or narrowly obtuse leaf apices, quadrate or hexagonal upper leaf cells, and two stereid bands in costal cross section, but differs in having more slender leaf apices, the median and upper leaf cells never bulging or having any trace of papillose cell walls, and the basal leaf cells with much thinner walls. In China, *B. satoi*, along with *B. ehrenbergii*, could be referred to the segregate genus *Hydro-*

gonium (Müll. Hal.) A. Jaeger, also in the Pottiaceae (Chen, 1941; Li et al., 2001).

Acknowledgments. I thank Noriaki Murakamo, the curator of the Makino Herbarium for the loan of the type specimens and Marshall Crosby (MO) for bringing to my attention the generic status of this Chinese taxon. I am grateful to Alain Vanderpoorten and an anonymous reviewer for valuable comments on the manuscript. Victoria Hollowell is appreciated for her editorial suggestions and corrections.

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Studies in the Cleomaceae VI: A New Genus and Sixteen New Combinations for the *Flora Mesoamericana*

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Abstract. New combinations are made for 16 mostly Mesoamerican Cleomaceae previously included in the genus *Cleome* L., s.l., and one species transferred from *Gynandropsis* DC. These are now considered to belong in the genera *Andinocleome* Iltis & Cochrane, which is newly described herein, *Mitostylis* Raf., *Physostemon* Mart. & Zucc., *Podandrogyne* Ducke, and *Tarenaya* Raf., as follows: *A. lechleri* (Eichler in Mart.) Iltis & Cochrane, *A. magnifica* (Briq.) Iltis & Cochrane, *A. pilosa* (Benth.) Iltis & Cochrane, *M. macrorhiza* (C. Wright in Sauvalle) Iltis, *M. procumbens* subsp. *obtusa* (Britton) Iltis, *M. procumbens* subsp. *wrightii* (Urb.) Iltis, *M. procumbens* subsp. *wrightii* var. *arenaria* (Urb.) Cochrane, *Physostemon humilis* (Rose) Iltis, *P. lanceolatum* Mart. subsp. *oaxacensis* (Iltis) Iltis, *P. lanceolatum* subsp. *paraguensis* (Iltis) Iltis, *P. stenophyllum* (Klotzsch in Urb.) Iltis, *Podandrogyne pulcherrima* (Standl.) Cochrane, *T. costaricensis* (Iltis) Iltis, *T. longipes* (Lamb. ex DC.) Iltis, and *T. parviflora* (Kunth in Humb., Bonpl. & Kunth) Iltis. Typifications are newly provided for *Cleome pilosa* var. *costaricensis* Donn. Sm. (lectotype), *C. applanata* Posada-Ar. (neotype), *C. humilis* Rose [≡ *Physostemon humilis* (Rose) Iltis] (lectotype), and *C. stenophylla* Klotzsch in Urb. [≡ *Physostemon stenophyllum* (Klotzsch in Urb.) Iltis] (lectotype).

Key words: *Andinocleome*, Cleomaceae, *Cleome*, *Gynandropsis*, Mesoamerica, *Mitostylis*, *Physostemon*, *Podandrogyne*, *Tarenaya*.

Work on the family treatment of Cleomaceae for the *Flora Mesoamericana* has required our renewed attention to the matter of segregate genera. As recently as 2005, Iltis was maintaining *Cleome* L. as a single diverse genus (Iltis, 2005a, 2005b), in keeping with floristic tradition. Since then, however, he has favored narrower generic concepts, and the division of *Cleome* into segregate genera, proposed in earlier works by de Candolle (1824) and Rafinesque (1838), was adopted and expanded in the *Flora of North America: North of Mexico*, Volume 7 (Iltis & Cochrane, 2007; Tucker & Vanderpool, 2010). The concepts of the groups, long recognized as sections or series (Iltis, 1952), have scarcely changed, only the rank at which these taxa are now recognized in our unpublished comprehensive synopsis of New World Cleomaceae. It is worth noting also that the revised generic-level classification is in keeping with a generic concept employed in a series of about 14 recent publications (e.g., Cornejo & Iltis, 2008, 2009; Iltis & Cornejo, 2011) in which New World *Capparis* L., s.l., of the closely related family Capparaceae, have been divided among 12 new or resurrected genera. The description of the new genus *Andinocleome* Iltis & Cochrane and the additional combinations provided here make the names available for the forthcoming volume of the *Flora Mesoamericana*. Other new combinations and changes in rank are still needed for Caribbean and South American taxa, including, for example, species cited as cleomes in the following section on *Andinocleome*.

Andinocleome Iltis & Cochrane, gen. nov. TYPE: *Cleome lechleri* Eichler in Mart. [= *Andinocleome lechleri* (Eichler in Mart.) Iltis & Cochrane].

Cleome L., pro parte min.

Hoc genus ab aliis generibus *Cleomacearum praecipue* disco nectarifero carnoso plerumque valde producto adaxialiter inflato, seminum fissura extrinsecus aperta membrana ungues conjungente (visibili no nisi in sectione longitudinali) in fissuram profunde invaginata eam in partem externam brevem et cubiculum internum parvum absconditum dividente atque chromosomatum numero majore distinguitur.

Small or usually very large herbs to subshrubs, shrubs, or small trees, 0.4–10 m, with internal phloem, unarmed (lacking spines), ± puberulent or glandular-puberulent or glandular-pilose. Leaves (3- to) 5- to 13-foliolate, the central leaflets 2–6 cm (e.g., *Cleome chilensis* DC.) or more often 3–30 cm, petiolate, exstipulate. Racemes very open to very dense, to 0.8 m; bracts (absent in *C. stylosa* Eichler) leafy, 1- or rarely the lower 3-foliolate; pedicels 13–45 mm. Sepals free or basally connate; corolla closed in bud, the petals at anthesis erect and adaxially disposed in a single row, in some species the margins tending to cohere, very variable in color, usually

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green, white, or yellow (rarely anthocyanic), slightly narrowed to the sessile base or constricted into a broad claw (narrowly clawed only in three small herbs of southern Andean xerophytic communities, i.e., *C. chilensis*, *C. limoneolens* J. F. Macbr., and *C. mathewsii* Briq., and rarely *Andinocleome pilosa* (Benth.) Iltis & Cochrane), thin to usually thick-membranous; nectariferous disk ± persistent, disciform or more often inflated adaxially and obliquely conic, obconic, or subhexagonal, small to usually prominent and massive; stamens 6, free from near the base of the gynophore, elongate; ovary cylindric to narrowly oblong or fusiform; gynophore 2–25(–80) mm. Fruits very variable in shape, from subspherical or obovoid to ellipsoid, oblong, fusiform, or most often slenderly cylindric, deflexed or pendent from the generally elongate gynophore (often 3–11 cm or more but less than 4 cm in 3 species of 13) and essentially continuous with it; valves thin to thick, usually opaque and brittle; seeds dark brown to black, suborbicular or broadly obovoid, the cleft on the outside open, the membrane connecting the claws (visible only in longitudinal section) ± deeply invaginated into the cleft, dividing it into an outer, short, open part and a small, hidden, V- or U-shaped, inner chamber; testa smooth to scurfy or ± conspicuously verrucose on the back, uniquely winged in *C. stylosa*, exarillate or (in *A. pilosa*) the radicular claw tipped by a minute funicular aril. Chromosome number: $2n = 58$.

Thirteen species belong in this genus, which was first described (under a different name, Iltis, 1952) as a new section of *Cleome*. Except for *Andinocleome pilosa* and *A. magnifica* (Briq.) Iltis & Cochrane, all are restricted to the Andes in South America. They fall into three well-defined small groups worthy of recognition as subgenera: the lowland mesophytic *A. pilosa*; three small annuals to subshrubs of xerophytic habitats; and 10 taxa of giant herbs, shrubs, or small trees of montane rainforests, cloud forests, and paramos. They are distinguished from other New World cleomes primarily by their distinctive seed structure, specialized nectariferous disk, and higher chromosome number. In most New World Cleomaceae the sinus between the radicular and cotyledonar claws, the seed cleft, is partly or completely covered by the testa or by a thin or firm, slightly sunken, visible membrane (Iltis, 1952; Iltis et al., 2011), but in *Andinocleome* (and also *C. stylosa*, *Dactylaena* Schrad. ex Schult. f., and *Podandrogyne* Ducke) the cleft is apparently open for most of its length, not covered by any external membrane; only the vertex is covered, this by the testa. However, a connecting membrane does occur. Visible only in the longitudinal section, it arises at or near the tips of the claws and penetrates from halfway to nearly all the way to the vertex near the center of the seed, dividing the cleft, whether short and wide or long and narrow, into an open outer section and a small, somewhat U- or V-shaped inner chamber (see our unpublished synopsis of New World Cleomaceae: fig. 3E–N; Sánchez-Acebo, 2005: 191, fig. 6B, C; Iltis et al., 2011: 31, fig. 2I–N, and 34, fig. 4). It should be mentioned that the internal morphology of the seeds of *Andinocleome* is somewhat similar to that of Old World species of *Cleome*, which generally have an open cleft but otherwise differ enough that they can be no more than distantly related to any New World Cleomaceae (Iltis, 1952, 1960).

The morphological evidence suggests that the newly established genus warrants equal status with other genera, such as *Cleoserrata* Iltis, *Hemiscola* Raf., *Peritoma* DC., and *Tarenaya* Raf. Recognizing their distinctiveness, Cochrane (1978) and Iltis and Cochrane (1989) indicated that *Andinocleome* and *Podandrogyne* represent a separate line of evolution, a view supported by the fact that these two genera share the unusual $n = 29$ chromosome complement ($2n = 58$ [Pazy, pers. obs.; Przywara, pers. obs.; Favarger & Huynh, 1965; Huynh, 1965; Ornduff, 1967; Cochrane, 1978]) in contrast to chromosome numbers of $2n = 18$, 20, 24, 32, 40, 48, or rarely 60 (and numbers derived from these) for the four aforementioned genera (for chromosome number references, see Iltis & Cochrane, 2007). More recent studies based on analyses of molecular characters have confirmed that five species each of *Andinocleome* and *Podandrogyne* belong to the same Andean subclade within Central-South American groups (Sánchez-Acebo, 2005; Inda et al., 2008) or a so-called *Polanisia* Raf. clade (Hall, 2008) and that this well-supported Andean subclade is sister to a clade composed of Old World *Cleome*, s. str.

1. Andinocleome lechleri (Eichler) Iltis & Cochrane, comb. nov. Basionym: *Cleome lechleri* Eichler in Mart., Fl. Bras. 13(1): 250. 1865. TYPE: Peru. Puno: prope Tabina, in fruticetis, July 1854, *W. Lechler 1859* (holotype, BR-6986209, BR photo & fragm. at WIS; isotypes, F-869661 [barcode v42682F], G-DC-197663/1 [barcode 226210], G-BOIS-197663/2 [barcode 226211], K-220469, LE, P, S, W).

Andinocleome lechleri is a common variable species that ranges from central Peru (Huánuco: *Woytkowski 34239*, F, LIL, MO, UC) to central Bolivia (Cochabamba: *Steinbach 5787*, F, G-DEL, GH, LIL, MO, SI), where it grows not only on shrubby

borders of streams and openings in cloud forests but also on waysides and near dwellings. It is distinguished by its white or purplish-white, usually eglandular, crispate indument, relatively large sepals, and relatively short gynophores and capsules.

2. **Andinocleome magnifica** (Briq.) Iltis & Cochrane, comb. nov. Basionym: *Cleome magnifica* Briq., Annuaire Conserv. Jard. Bot. Genève 17: 367. 1914. TYPE: Mexico. Michoacán or Guerrero: "Crète de la Sierra Madre, sol argileux," 17 Feb. 1899, *E. Langlassé 891* (holotype, G-197319/1 [barcode 226178]; isotypes, B [barcode 100242703], B [barcode 100242704], F-86951 [barcode v53127F], G-DC-197319/2 [barcode 226179], GH-42303, K-220443, P-745096, US-385422 [barcode 100485]).

Andinocleome magnifica occurs in the Mexican states of Hildalgo (*Schiede s.n.*, photo F ex B, as *Cleome parvisepala* Heilborn), Guerrero (*Hinton 14286*, GH, NA, NY, US), Mexico (*Hinton 9008*, GH, K, NA, NY, PH, US), Oaxaca (*Nelson 1815*, GH, US), Veracruz (*Botteri 486*, F, GH, US), and possibly Michoacán (*Langlassé 891*, type) and the Guatemalan departments of Guatemala (*Morales 934*, US), Quetzaltenango (*Standley 67406*, F), and San Marcos (*Standley 66159*, F). The species grows in thickets and wet forests, mostly along streams and in gullies and ravines, also in oak-pine forests. Key characters are its large flowers and fruits, the largest in the genus; essentially sessile petals; large turbinate-conic disk, which, however, shrinks and becomes inconspicuous in fruit; and elongate gynophores reaching 9 cm.

3. **Andinocleome pilosa** (Benth.) Iltis & Cochrane, comb. nov. Basionym: *Cleome pilosa* Benth., Bot. Voy. Sulphur 65. 1844. TYPE: Ecuador. [Manabi:] Salango, 1843, *A. Sinclair s.n.* (holotype, K-220472, K photo at WIS; isotype, K-220471, ex herb. Hooker via herb. Bentham).
Cleome applanata Posada-Ar., Estudios Científicos 417. 1909, ex char. et fide *Uribe Uribe* (sub no. *1102*, US). TYPE not designated: Colombia. Medellín: "camino 'el Guamal', salida a El Poblado," 15 Dec. 1945, *L. Uribe Uribe 1102* (neotype, designated here, COL, WIS [fragm.]; isoneotype, US-1900016).

No type was designated in the protologue of *Cleome applanata*; indeed, no specimen at all was cited, and therefore a neotype must be selected. Because Posada-Arango (1909) specifically stated that the plant could be found in the vicinity of Medellín on the borders of the road from Guamal that goes to Poblado, and because Uribe Uribe not only listed on his label at COL the same common name ("mismia") used by Posada-Arango but also added on the sheet at US a confirming note ("esta es la *Cleome applanata* Posada"), we select the Uribe Uribe specimen as the neotype.

Andinocleome pilosa is polymorphic and widespread, ranging throughout the southern half of Mexico (Edo. Mexico: *Hinton 8491*, F, G, GH, K, NY) and Central America (Costa Rica: *Tonduz 1450*, BR, C, G, M, P, US) to Ecuador (*Eggers 15100*, F, K, M) and Venezuela (*Fendler 26*, G, GH, K, MO, NY, PH) and reappearing on Hispaniola (Haiti: *Ekman H1374*, US). Presumably, it is the most primitive species within *Andinocleome* (Iltis, 1952; Cochrane, 1978), differing from other members of the genus most notably in having the radicular claw of the small seed tipped by a minute funicular aril and the valves of the capsule thin, flexible, and somewhat translucent. The thin-textured petals are usually white but vary to shades of pink or purple, and the nectariferous disk is relatively small.

Mitostylis Raf.

Because of the fact that it has unifoliolate leaves, *Mitostylis* was treated as part of *Cleome* sect. *Physostemon* (Mart. & Zucc.) Benth. & Hook. f. by Iltis (1959), who now believes that the resemblance is superficial owing to convergence. *Mitostylis* is differentiated from *Physostemon* Mart. & Zucc. by the perennial (rarely annual) habit; decumbent to ascending stems and branches; minute, epulvinate, subsessile or very short-petiolate leaves; flowers borne singly in the axils of leaves; relatively long pedicels; exapophysate filaments; and small capsules. No chromosome number has been recorded for this genus, which, as presently accepted by us, comprises two, almost exclusively West Indian species (Iltis, 1959; Rankin Rodríguez, 2003): *M. procumbens* (Jacq.) Raf., which includes three subspecies, and *M. macrorhiza* (C. Wright in Sauvalle) Iltis, which pertains to the Flora Mesoamericana area.

1. **Mitostylis macrorhiza** (C. Wright) Iltis, comb. nov. Basionym: *Cleome macrorhiza* C. Wright in Sauvalle, Anales Acad. Sci. Méd. Habana 5: 199. 1868. TYPE: Cuba. Pinar del Río: Pinar del Río, Oct. 1865, *C. Wright 3495* [sometimes *s.n.* or incorrectly marked *1868*] (lectotype, designated by Rankin Rodríguez, [2003: 441], GH-42323; isolectotypes?, B [barcode 100088710], BREM, G, GOET [p.p., fide Rankin Rodríguez (2003)], K-76951, MO-2031904 [barcode 247746], NY [barcode

22653], NY [barcode 74436], NY [barcode 74437], P, S [2 sheets, one mixed with *Cleome procumbens*, fide Rankin Rodríguez (2003)], US-6582 [barcode 100484], W).

Many sheets collected by Wright in Pinar del Río are currently associated with either *Cleome wrightii* or *Mitostylis macrorhiza*. Although type specimens of the former species invariably bear the number *1868*, "... many collections of authentic (type?) material of *C. macrorhiza* also carry this number, as do several collections containing varying mixtures of both species" (Iltis, 1959: 143). The confusion apparently results from the number 1868 having been copied from Grisebach's catalogue (1866: 6), in which it was equated with *C. procumbens* Jacq.

Mitostylis macrorhiza is found exclusively in westernmost Cuba (Iltis, 1959; Rankin Rodríguez, 2003) except for a single disjunct station on the eastern coast of Belize (*Dwyer & Berry 15010*, MO). Its presence there, in a savanna at the entrance to a then-new highway, might be due to human introduction but could just as well represent a natural occurrence. It is distinguished from congeneric taxa by its ascending to erect habit, few, distantly spaced, narrow leaves, and relatively larger flowers and seeds.

2. Mitostylis procumbens (Jacq.) Raf., Sylva Tellur. 114. 1838. Basionym: *Cleome procumbens* Jacq., Enum. Syst. Pl. 26: 1760. TYPE (not designated): Greater Antilles. tab. 120 in Select. Stirp. Amer. 1763: 189 (neotype, designated by Rankin Rodríguez [2003: 441]).

Iltis (1959) stated that the type is *Jacquin s.n.* but did not indicate that he had seen such a specimen, the existence of which has not been traced.

2a. Mitostylis procumbens (Jacq.) Raf. subsp. **procumbens.**

Subspecies *procumbens* has the broadest geographical distribution of the three subspecies recognized for *Mitostylis procumbens*, occurring in Jamaica, southeastern Cuba, and Hispaniola in grassy, sandy, or stony coastal habitats as well as mangroves, marshes, and pastures (Iltis, 1959; Rankin Rodríguez, 2003). It is a little more robust than the other two subspecies and is characterized by relatively long, narrow leaves on relatively long petioles, ciliolate sepals, and slenderly cylindric, terete capsules to 26 mm long.

2b. Mitostylis procumbens subsp. **obtusa** (Britton) Iltis, comb. nov. Basionym: *Cleome obtusa* Britton, Bull. Torrey Bot. Club 44: 2. 1917. *Cleome procumbens* subsp. *obtusa* (Britton) R. Rankin, Willdenowia 33: 441. 2003. TYPE: [Cuba.] Camaguey: near Camaguey, 2 Apr. 1912, *N. L. Britton, E. G. Britton & J. F. Cowell 13165* (holotype, NY-74438).

Rankin Rodríguez (2003: 441) clearly intended to publish a new combination and a new rank based on *Cleome obtusa* Britton but mistakenly cited Urban as the author of the epithet when reducing it to subspecific rank and when listing the autonym *C. obtusa* var. *obtusa* among the synonyms.

Mitostylis procumbens subsp. *obtusa* is endemic to the eastern two thirds of Cuba, where it is common in open spots in moist grasslands, savannas, and sandy places (Iltis, 1959; Rankin Rodríguez, 2003). The stems bear papillose ridges, and the leaves, flowers, and fruits (quite variable in overall shape, terete to compressed, and 3–9 mm long) are all small, helping to distinguish it from other taxa in the genus.

2c. Mitostylis procumbens subsp. **wrightii** (Urb.) Iltis, comb. nov. Basionym: *Cleome wrightii* Urb., Symb. Antill. 5: 346. 1907. TYPE: [Cuba.] 1860–1864, *C. Wright 1868* (holotype, B-100088706 ex herb. Krug & Urban; isotypes, BM-629052, BREM, F-118739 [barcode v53135F], G, GH-42325, K-76952, LE, MA-608769, MO-2031928, NY-22654, NY-74440, S, US-6583 [barcode 100500]).

Wright 1868 pertains to the type collection of this taxon only, not to original material of *Mitostylis macrorhiza* incorrectly listed as no. 1868. See also remarks under the preceding species.

Endemic to western Cuba and the Isla de la Juventud (formerly Isla de Pinos) (Iltis, 1959; Rankin Rodríguez, 2003), *Mitostylis procumbens* subsp. *wrightii* grows in dry to moist palm savannas, grasslands, and sandy places. Within *Mitostylis*, subspecies *wrightii* is most similar to *M. procumbens* subsp. *obtusa*, but its stems are smooth or scarcely papillose, and it produces longer leaves, flowers, and fruits (uniformly slender and terete, 7–18 mm long). Two varieties are further recognized within subspecies *wrightii* for *M. procumbens*.

2c (1). Mitostylis procumbens (Jacq.) Raf. var. **wrightii** (Urb.) Cochrane, comb. nov. Basionym: *Cleome wrightii* Urb., Symb. Antill. 5: 346. 1907. *Cleome procumbens* var. *wrightii* (Urb.) R. Rankin, Willdenowia 33: 442. 2003.

Mitostylis procumbens var. *wrightii* is known only from two provinces of western Cuba (Iltis, 1959; Rankin Rodríguez, 2003). It may be distinguished

from variety *arenaria* associated with *M. procumbens* subsp. *wrightii* by its more or less erect stems, larger leaves, and less strongly tuberculate seeds.

2c (2). Mitostylis procumbens (Jacq.) Raf. var. **arenaria** (Urb.) Cochrane, comb. nov. Basionym: *Cleome arenaria* Urb., Repert. Spec. Nov. Regni Veg. 22: 36. 1925. *Cleome procumbens* var. *arenaria* (Urb.) R. Rankin, Willdenowia 33: 442. 2003. TYPE: [Cuba. Isla de la Juventud:] Isla de Pinos prope Santa Bárbara, 3 Nov. 1920, *E. L. Ekman 12064* (holotype, B-100088707; isotypes, S [2]).

Iltis, in his revision of *Cleome* sect. *Physostemon* (1959), and in our unpublished synopsis of New World Cleomaceae, regarded this local endemic from Isla de la Juventud as a minor variant not worthy of taxonomic recognition, whereas Rankin Rodríguez (2003: 443), bolstered by the realization that the specimen *Blain 49* (F) must have come from the main island of Cuba, and not the Isle of Pines, thought this population should have varietal rank and be associated with *C. procumbens* subsp. *wrightii*. Individually, any one of the tendencies toward ascending (instead of erect) stems, or somewhat smaller, narrower leaves, or barely larger, more prominently tubercled seeds would not be of much taxonomic significance, but taken together, these features suggest the occurrence of a discrete, albeit weakly differentiated population. In Cochrane's opinion the correlation of morphological characters and geographical distribution lends weight to the argument for varietal validity, although Iltis's preference remains merely to call attention to the variant and let it go at that.

Physostemon Mart. & Zucc.

Physostemon consists of 10 species (13 taxa) of very slender annuals or small perennials with unifoliolate (3- to 5-foliolate only in *P. humilis* (Rose) Iltis), sessile or short-petiolate leaves (relatively long-petiolate only in *P. humilis*), open flower aestivation, often ciliolate or irregularly toothed petals, obsolete disks, and small, sessile or subsessile fruits with setaceous styles (Iltis, 1959). The chromosome number(s) are still unknown. Although several populations occur in the Caribbean region, the bulk of the species are about evenly divided between Mexico and South America, five of them occurring in the *Flora Mesoamericana* region.

1. Physostemon humilis (Rose) Iltis, comb. nov. Basionym: *Cleome humilis* Rose, Contr. U.S. Natl. Herb. 5: 196. 1899. *Cleome tenuis* S. Watson subsp. *humilis* (Rose) Iltis, Brittonia 11: 138. 1959. TYPE: Mexico. Zacatecas: tropical valleys of the table land, San Juan Capistrano, 22 Aug. 1897, *J. N. Rose 2479* (lectotype, designated here, US-301394 [barcode 100477]; isolectotypes, GH-42302, MEXU).

According to the protologue, the collection number of the type is *2429*, but this is a mistake. Firstly, the specimens identified as types by Iltis (1959) are marked "Cleome humilis Rose sp. nov." in what an authority at US believes is almost certainly Rose's handwriting. They are labeled *2479*, albeit in a different script, not Rose's but probably that of an assistant who was in charge of preparing the labels during the processing of expedition collections. The lectotype also has a handwritten slip ("2479") mounted together with the regular label. Secondly, collection details pertaining to no. *2479* are in agreement with the protologue, whereas the locality and date on the only other known collection of *C. humilis* made by Rose, no. *2900*, are different. Thirdly, a simple error in reading could result in the number 7 being transcribed as a "2." A search of 12 online herbaria catalogues failed to turn up any reference to *Rose 2429*.

Physostemon humilis is restricted to mesophytic mountainous habitats in central Mexico (Iltis, 1959). It can be identified by the combination of its annual habit, 3-foliolate leaves with relatively long petioles (3–37 mm), narrow leaflets, flowers borne in terminal, ebracteate racemes, and narrow petals.

2. Physostemon lanceolatum Mart. & Zucc., Flora 7(1) (Beil. 4): 139. 1824. *Cleome lanceolata* (Mart. & Zucc.) Iltis, Brittonia 11: 149. 1959. TYPE: Brazil. Pernambuco-Bahia border: "ad Joazeiro et Terram Novam praedius," 1823, *C. F. P. von Martius s.n.* [*2415*] (holotype, M; isotypes, C, G-197683/1 [barcode 226214], G-197683/2 [barcode 226215], G-197683/3 [barcode 226216], K-220444, L, LE).

2a. Physostemon lanceolatum Mart. & Zucc. subsp. **lanceolatum**.

Physostemon lanceolatum subsp. *lanceolatum* is endemic to northeastern Brazil in the region of the caatingas (Iltis, 1959). It is usually found in dry to moist, sandy or grassy habitats and open ground generally, including along rivers and on roadsides. Within the species, the subspecies *lanceolatum* is morphologically more similar to *P. lanceolatum* subsp. *paraguensis* (Iltis) Iltis than it is to *P. lanceolatum* subsp. *oaxacensis* (Iltis) Iltis (see below).

Both subspecies tend to be smaller vegetatively and less branched than the latter, and they have shorter fruiting pedicels and smaller seeds than subspecies *oaxacensis*.

2b. Physostemon lanceolatum Mart. & Zucc. subsp. **oaxacensis** (Iltis) Iltis, comb. nov. Basionym: *Cleome lanceolata* (Mart. & Zucc.) Iltis subsp. *oaxacensis* Iltis, Brittonia 11: 151. 1959. TYPE: Mexico. Oaxaca: San Gerónimo, 5 Oct. 1933, *Mell 2124* (holotype, US-1588863 [barcode 100482], US photo at WIS; isotype, NY-387669).

Physostemon lanceolatum subsp. *oaxacensis* inhabits savannas and clearings in thorn forests from southern Mexico (Oaxaca: *Mell 2124*, type; Chiapas: *Matuda 16964*, CAS, F, MEXU, WIS) to Belize (*Dwyer & Liesner 12193*, WIS). Although "nearly indistinguishable" (Iltis, 1959: 151) from *P. lanceolatum* subsp. *lanceolatum* and *P. lanceolatum* subsp. *paraguensis*, it differs from the first by the less prominent apophyses and from both of these by the longer, more strongly ascending pedicels and capsules, larger seeds, and geographically isolated distribution.

2c. Physostemon lanceolatum Mart. & Zucc. subsp. **paraguensis** (Iltis) Iltis, comb. nov. Basionym: *Cleome lanceolata* (Mart.) Iltis subsp. *paraguensis* Iltis, Brittonia 11: 152. 1959. TYPE: Paraguay. Gran Chaco: Loma Clavel, 23°20′S, Nov. 1903, *T. Rojas* [*É. Hassler*] *2598* (holotype, SI; isotypes, GH-42333, MO-1573664 [barcode 247717], NY-215157, P).

Physostemon lanceolatum subsp. *paraguensis* occurs in dry sandy habitats from Mato Grosso, Brazil, to Paraguay and adjacent Argentina (Iltis, 1959) and Bolivia (*Krapovickas & Schinini 31127*, CTES, WIS). It resembles *P. lanceolatum* subsp. *lanceolatum* in that both have relatively short, often more or less curved pedicels, but its filaments lack apophyses, and its seeds are larger. The two subspecies are allopatric.

3. Physostemon stenophyllum (Klotzsch in Urb.) Iltis, comb. nov. Basionym: *Cleome stenophylla* Klotzsch in Urb., Symb. Antill. 4(2): 251. 1905. TYPE: Puerto Rico. "Coamo, in pratis," 4 Jan. 1886, *P. E. E. Sintenis 3314* (lectotype, designated here, US-1392162 [barcode 658027], US digital image at WIS; isolectotypes, BR, CORD, G, LE, M, P).

Physostemon stenophyllum is distributed in parts of the West Indies, Lesser Antilles, Guianas, and Colombia (Iltis, 1959). It is notable for having stiff stems and branches, relatively long petioles, terminal racemes with highly reduced, setaceous bracts and the flowering portion very short, and erect fruits.

Podandrogyne Ducke

Podandrogyne, separable from *Cleome*, s.l., on the basis of a suite of characters (see Woodson, 1948; Iltis & Cochrane, 1989; Sánchez-Acebo, 2005; Cochrane, 2011), was considered a specialized genus of Cleomaceae by Iltis (1950). As indicated by Cochrane (2011), its approximately 36 species are concentrated in the northern Andes (except for *P. glabra* Ducke) above 500 m but range into the high mountains from Panama to Guatemala and Honduras, a region that includes five species relevant to the *Flora Mesoamericana*, including the following one.

1. Podandrogyne pulcherrima (Standl.) Cochrane, comb. nov. Basionym: *Gynandropsis pulcherrima* Standl., J. Washington Acad. Sci. 17(10): 253. 1927. TYPE: Costa Rica. Guanacaste, near Tilarán, 10–31 Jan. 1926, *P. C. Standley & J. Valerio 44560* (holotype, US-1253694).

This handsome suffruticose herb has unisexual (almost always), bright to pale reddish-orange, orange, or coral-pink flowers in a dense corymbiform raceme. Frequent in montane Central America, its range extends from Guatemala (*Steyermark 41981*, F) to the province of Coclé, Panama (*Hunter & Allen 552*, G, MO, WIS), where it typically occurs in rainforest formations on ridges and slopes, often next to streams or waterfalls or in ravines, also in pastures, at anywhere from 400 to 2100 m.

Podandrogyne pulcherrima is extremely similar to the allopatric *P. chiriquensis* (Standl.) Woodson, and for over 50 years the consensus has been to treat it as a synonym of the latter, which traditionally has been accepted as the only species of the small, clearly delimited corymbiform section of the genus in Central America. However, in view of the large number of herbarium collections from that region and the amount of morphological variation they exhibit, it is remarkable that potential new taxa have been passed over for so long. The situation is complicated by the occurrence in Panama and Costa Rica of a misunderstood species, namely, the rather widespread and variable *P. decipiens* (Triana & Planch.) Woodson found primarily in South America, making it necessary to have some familiarity with the latter before being able to reach a satisfactory understanding of the Central American taxa. Altogether, it now seems preferable to Cochrane not only to regard *P. decipiens*, *P. chiriquensis*, and *P. pulcherrima* as

separate species but also to recognize three additional taxa at subspecies rank within the complex.

Tarenaya Raf.

Iltis and Cochrane (2007) reviewed the taxonomy of the very diverse genus *Tarenaya* in a previous paper in this series. Although five of its 30 species have never been published and the majority of the remainder has yet to be formally transferred to *Tarenaya*, the following additional nomenclatural combinations are needed immediately for the treatment of the Cleomaceae for *Flora Mesoamericana*.

1. **Tarenaya costaricensis** (Iltis) Iltis, comb. nov. Basionym: *Cleome costaricensis* Iltis, Brenesia: 63–64: 1. 2005. TYPE: Costa Rica. Cartago: costado O del campus del Inst. Tecnol. Costa Rica, 25 Nov. 1986, *N. Zamora V. 1309* (holotype, CR; isotypes, B [barcode 100242711], BM, C, CR, DUKE, F-2178831 [barcode v53123F], GH-76833, K-220428, K-220429, MEXU, MO-5051003 [barcode 107290], NY-707, P, PMA, S, SMU, TEX, UC, US-3351741 [barcode 588883], WIS [5], XAL).

Although nearly endemic to the Valle Central of Costa Rica, *Tarenaya costaricensis* reappears in western Panama in the vicinity of El Hato de Volcán and Las Lagunas (Iltis, 2005b), originally growing in wet thickets but now typically found on weedy roadsides and in pastures and city lots. It is most closely related to *T. spinosa* (Jacq.) Raf., sharing with the latter large, normally whitish petals (in bud marked or suffused adaxially with dark pink to red-violet), large sepals and anthers, and long gynophores. However, it differs in having smaller leaflets with fewer lateral veins on each side of the midrib, petiolate bracts spaced farther apart, glabrous capsules, and larger seeds.

2. **Tarenaya longipes** (Lamb. ex DC.) Iltis, comb. nov. Basionym: *Cleome longipes* Lamb. ex DC., Prodr. 1: 239. 1824. TYPE: [Ecuador. Guayas:] in Huyaquil, s.d., *s. coll.*, *s.n.* (holotype, G-207155 [G-DC. ex herb. Lambert]).

It is likely that the type of *Cleome longipes* Lamb. ex DC. [≡ *Tarenaya longipes* (Lamb. ex DC.) Iltis] is a fragment of the original Ruiz collection made at Guayaquil and preserved at Berlin (B [barcode 100242706]).

This species is distributed in Costa Rica (*Stork 1195*, F, MICH), Panama (*Woodson & Schery 1025*, MO, NY, US), Ecuador (*Camp E-1550*, G, MG, MO, NY), and Amazonian Peru (*Woytkowski 34374*, F, MO, USM). It is readily recognized by its habit, being a giant, thorny scrambler that clambers over neighboring plants, and its infructescences, which present an imposing, orderly arrangement of very slender, strongly contorted capsules pendulous on greatly elongated, wiry gynophores.

3. **Tarenaya parviflora** (Kunth) Iltis, comb. nov. Basionym: *Cleome parviflora* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. (quarto ed.) 5: 83. 1821, non *Cleome parviflora* R. Br., Voy. Abyss. [Salt] Append. lxv. 1814 [Sep.], nom. nud. TYPE: [Colombia?] "Crescit in calidis Novae Granatae?," s.d., *F. W. H. A. Humboldt & A. Bonpland s.n.* (holotype, P-679903 [P-Bonpl.], P photo at F).

Tarenaya parviflora ranges from southern Mexico (Oaxaca: *Williams 9490*, F, G) to the Guianas (Suriname: *Went 5089*, U, US), northern Peru (*Williams 1468*, F), and Amazonian Brazil (Amazonas: *Ule 6031*, B, G, K, L, MG), usually occurring in shaded swampy habitats but also as a weed, generally at very low elevations. Typically, plants are abundantly armed with prickles at the nodes and on the petioles and midribs but otherwise are subglabrous. They have thin-textured leaves, small, white, pink or green to greenish-purple flowers with relatively short gynophores, and characteristic seed morphology similar to that shown for *Cleome trachycarpa* Klotzsch ex Eichler in Iltis et al. (2011: 31, fig. 2Q, R): a very large, nearly spherical internal cleft chamber closed at the mouth and covered with a thin, nearly flush (rather than sunken or convex) membrane.

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A New Species of *Alyssum* (Brassicaceae) from Northeastern Iran

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ABSTRACT. *Alyssum hezarmasjedense* Kavousi & Nazary (Brassicaceae) is described as a new species from Khorassan Province in northeastern Iran. The morphological characters of the sepals being dimorphic and appearing connate, with the inner surface indument, support the placement of the new species in *Alyssum* L. sect. *Gamosepalum* (Hausskn.) Dudley. The new species is closely related to *A. misirdalianum* Orcan & Binzet.

Key words: *Alyssum*, Brassicaceae, Iran, IUCN Red List, Khorassan.

The genus *Alyssum* L. (Brassicaceae) includes ca. 31 species across the geographic area covered by the *Flora Iranica* (Rechinger, 1968). Later studies have added new species (Kavousi, 2001; Kavousi et al., 2010, 2011), and including the new species herein, the total number of *Alyssum* species in Iran increases to 52. In 2008 during a floristic survey of Chenaran County, a specimen of *Alyssum* was collected at Hezarmasjed Mountain in Khorassan Province. After research in the literature (Dudley, 1964a, 1964b) and examination of other *Alyssum* specimens at FUMH and TARI, it was determined that the new specimens were different from all other *Alyssum* collections, particularly within *Alyssum* sect. *Gamosepalum* (Hausskn.) Dudley, and thus represent a new taxon.

Alyssum hezarmasjedense Kavousi & Nazary, sp. nov. TYPE: Iran. Khorassan: NE Chenaran Co., 31 km from Boghmech to Hezarmasjed Mtn., 2344 m, 22 May 2008, *Z. Nazary & H. Zangoii 39391* (holotype, FUMH; isotypes, FUMH [2], MO). Figure 1.

Haec species *Alysso misirdaliano* Orcan & Binzet affinis, sed ab eo caule 3–7(9) cm (vs. 10–20 cm) alto, indumento solum lepidoto (vs. mixto, lepidoto et stellato), petalis spathulatis (vs. obovatis), filamentis bilateraliter alatis exappendiculatisque atque siliculis 3.5–4 × 2.5–3.5 mm (non 6–7 × 3–4.5 mm) differt.

Perennial herbs, dwarf, stems erect or ascending from procumbent bases, 3–7(9) cm tall, plant indumentum uniformly of dense, silvery canescent, adpressed lepidote hairs; sterile shoot aggregate raised on the based fertile stem. Sterile shoot leaves, 5–8 × 1–1.5 mm, narrowly oblanceolate to linear, acute, petiolate; leaves on flowering stems 7–10 × 1–2 mm, narrowly oblanceolate, acuta decreasing in size apically. Inflorescence a congested corymb with 8 to 10 flowers, 1–3 cm; peduncle 12 mm, pedicels erect, patent, 3.5–4.5 mm in fruit. Sepals dimorphic, 3–3.5 × 2.5–3 mm, somewhat saccate, the external pair ovate, the internal pair oblanceolate or obovate, both hyaline, apex acute, densely pubescent; petals 4.5–5.5 mm, yellow, spatulate, patent to adpressed, apex retuse, the claw irregularly denticulate to sinuate; stamens didynamous, the longer four 4.5–5.5 mm, lacking an appendage, the filaments bilaterally winged, the shorter stamen pair 2.5–3 mm, also winged, with a unilateral appendage, 0.5 mm, at the base; ovary with the style 2.5–3 mm, with lepidote hairs on the base. Fruit as sillicles 3.5–4 × 2.5–3.5 mm, orbicular to ovate, truncate, sessile; seeds uniseriate, wingless; locules 2-ovulate.

Distribution and habitat. *Alyssum hezarmasjedense* was collected from serpentine steppe at an altitude of ca. 2344 m. The new species is endemic to Khorassan Province, Iran, and is known from the type locality.

IUCN Red List category. *Alyssum hezarmasjedense* is endemic to Hezarmasjed Mountain, with the number of mature individuals less than 250 as noted

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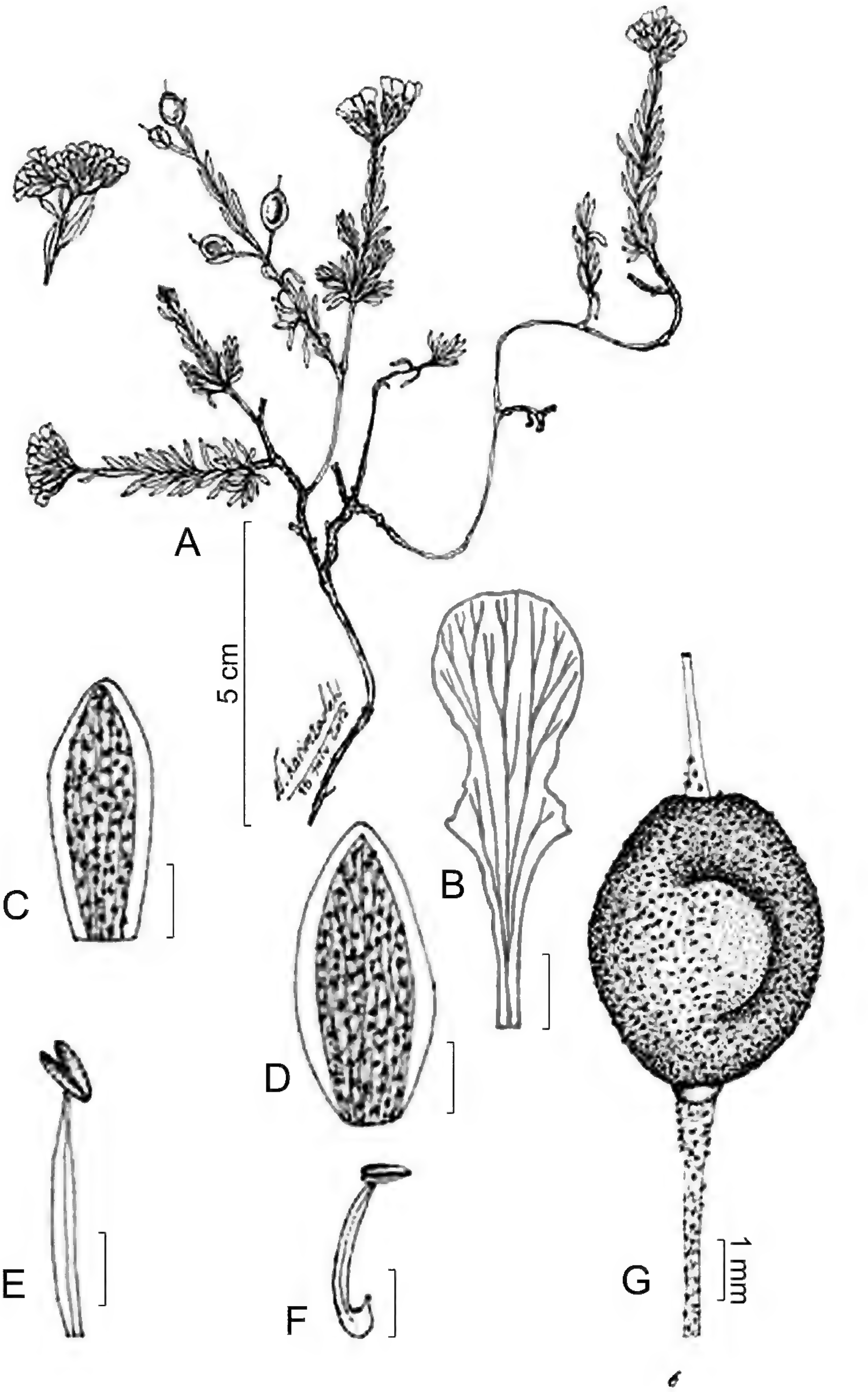


Figure 1. *Alyssum hezarmasjedense* Kavousi & Nazary. —A. Fertile habit. —B. Petal. —C. External sepal. —D. Internal sepal. —E. Long stamen. —F. Short stamen. —G. Silicule. A is drawn from the holotype, *Z. Nazary & H. Zangoii 39391* (FUMH); B–G are taken from the isotype at FUMH. Scale bars for B–G = 1 mm.

from the type locality. The population is not in good condition due to grazing. The new species should therefore be regarded as Critically Endangered (CR), according to IUCN Red List categories and criteria (IUCN, 2001).

Phenology. *Alyssum hezarmasjedense* has been observed to flower in April and May and to fruit in May and June.

Etymology. The new species is named for the type locality, in honor of Hezarmasjed Mountain.

Table 1. Morphological comparison of *Alyssum hezarmasjedense* Kavousi & Nazary with the related species *A. misirdalianum* Orcan & Binzet in Turkey.

	A. hezarmasjedense	*A. misirdalianum*
Plant height (cm)	3–7(9)	10–20
Leaves	5–10 × 1–2 mm, narrowly oblanceolate, acute	5–15 × 2–3 mm, oblanceolate, obtuse
Petal shape	spatulate	obovate
Stamens, didynamous, the longer four	4.5–5.5 mm, not appendaged, bilaterally winged	3–3.5 mm, appendaged, either connected or free
Silicles (mm)	3.5–4 × 2.5–3.5	6–7 × 3–4.5
Plant indument	consistently with dense silvery canescent, lepidote trichomes	mixed, with both lepidote and stellate trichomes
Geographic distribution	northeastern Iran, Khorassan Province, endemic to Hezarmasjed Mountain	South Anatolia, Turkey, Mersin Province

Discussion. *Alyssum hezarmasjedense* is placed in *Alyssum* sect. *Gamosepalum* because of its perennial habit, the dimorphic sepals, and the 2-ovulate locules. *Alyssum hezarmasjedense* is morphologically the nearest species to *A. misirdalianum*, which is not found in Iran. *Alyssum hezarmasjedense* is endemic to Hezarmasjed Mountain in Khorassan Province, whereas *A. misirdalianum* has been only known from south Anatolia in Turkey (Orcan & Mısırdalı, 1998). *Alyssum misirdalianum* is also placed in *Alyssum* sect. *Gamosepalum*. Both species have stem leaves that acropetally decrease in size upward and belong to *Alyssum* sect. *Gamosepalum*, ser. *Libera* Dudley. *Alyssum hezarmasjedense* is distinguished from *A. misirdalianum* in its plant height, 3–7(9) cm (vs. 10–20 cm in *A. misirdalianum*); the densely and consistently silvery canescent indumentum, with only adpressed lepidote trichomes (vs. mixed trichome types, lepidote and stellate); and the spatulate petals (vs. obovate petal shape; see Table 1).

The two species can be distinguished by the following key couplet:

1a. Plants 10–20 cm; petals obovate, with indument of both stellate and lepidote trichomes ..... *A. misirdalianum*
1b. Plants 3–7(9) cm; petals spatulate, with indument of only lepidote trichomes ..... *A. hezarmasjedense*

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A New Species of *Drypetes* (Putranjivaceae or Euphorbiaceae s.l.) from Madagascar

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ABSTRACT. *Drypetes birkinshawii* McPherson (Putranjivaceae or Euphorbiaceae s.l.), a new species of *Drypetes* Vahl, is described, differing most notably from the similar *D. perrieri* Leandri in having staminate flowers subtended by minute bracts (< 0.5 mm vs. 1.5 mm) and displaying three sepals (vs. four) and three stamens (vs. four) as well as in having glabrous fruits (vs. pubescent). Both species also share rather small leaves (typically less than 7 × 4.5 cm) and a bilocular, 2-styled ovary.

Key words: *Drypetes*, Euphorbiaceae, IUCN Red List, Madagascar, Putranjivaceae.

Drypetes Vahl (Putranjivaceae or Euphorbiaceae s.l.) is a pantropical genus of ca. 200 species (Radcliffe-Smith, 2001), 10 of which are now recognized as endemic to Madagascar (McPherson, 2000). Being dioecious plants, the species of this genus are rarely observed in full staminate flower, but a morphologically distinctive specimen in this condition collected recently in northeastern Madagascar makes necessary the following new species description.

Drypetes birkinshawii McPherson, sp. nov. TYPE: Madagascar. Antsiranana: Anjangoveratra, Antanandava, 400 m, 14°10′15″S, 49°57′18″E, 4 May 2010 (fl.), *C. Birkinshaw, S. Liede, C. M. Taylor & Ratsidy 1793* (holotype, MO; isotypes, P not seen, TAN not seen). Figure 1.

Species nova *Drypeti perrieri* Leandri affinis, a qua ramulis glabris, floribus staminatis bracteis parvulis subtentis, sepalis tribus sparsim pubescentibus, staminibus tribus et fructibus glabris differt.

Tree 9–15 m, diameter at breast height 25–70 cm; young branchlets glabrous. Leaves with stipules usually caducous, triangular, ca. 0.5–0.7 mm, glabrous; petioles (4–)7–12 mm × 1 mm, canaliculate, glabrous; blades broadly elliptic to slightly ovate in general outline, 3.5–7 × 2–4.3 cm, acute to obtuse and shortly attenuate at the base, sometimes slightly asymmetric, acuminate at the apex, glabrous on both surfaces, the margin nearly entire to occasionally shallowly crenate, with 6 to 7 pairs of minute teeth discernible on close inspection of at least the younger leaves; midrib raised abaxially but not adaxially; secondary veins 6 to 7, slightly raised and evident on both surfaces, as is the lesser venation. Staminate flowers in fascicles of 8 to 24 flowers; basal bracts obscure, less than 0.5 mm; pedicels 4–6 mm, sparsely pubescent with sub-appressed hairs; calyx usually of 3 sepals; sepals 2–3 mm × ca. 1 mm, concave, obtuse at the apex, sparsely pubescent abaxially, often ciliate; stamens three, 2.5–5 mm, the anthers 1 mm; disk broadly cup-shaped, ca. 0.5 mm × 1.5 mm, shallowly lobed, glabrous abaxially, pubescent adaxially; pistillode absent. Pistillate flowers unknown. Fruit pedicels 2–4 mm × 1.5–2 mm; sepals not persistent in fruit; disk pubescent adaxially at least at first, the indument eventually lost as the disk is deformed by the enlarging fruit; fruit (immature) bilocular, sub-spherical, 15–18 mm diam., unlobed, glabrous, with 2 stigmas 0.5 mm.

Distribution and ecology. Despite more than 150 years of collecting activity in the humid evergreen forests of eastern Madagascar, *Drypetes birkinshawii* is currently known from only three gatherings recently made at two localities near the northern and southern ends of these forests, at elevations between 75 and 400 m and on basement rock (migmatites and granites) or laterite.

IUCN Red List category. Direct or indirect assessment of the risk of extinction in this case is not supported by adequate information, since the range of the taxon is thought to be rather wide and the three records are all recent collections; hence a threatened status is not justified, and the category Data Deficient (DD) is appropriate (IUCN, 2001).

Phenology. Data are few, but *Drypetes birkinshawii* is known to flower in May and has been collected in immature fruit in November.

Etymology. Dr. Chris Birkinshaw (1962–), long-time coordinator of many of the Missouri Botanical Garden's projects in Madagascar, prepared the excellent specimen that is here designated the type of this species.

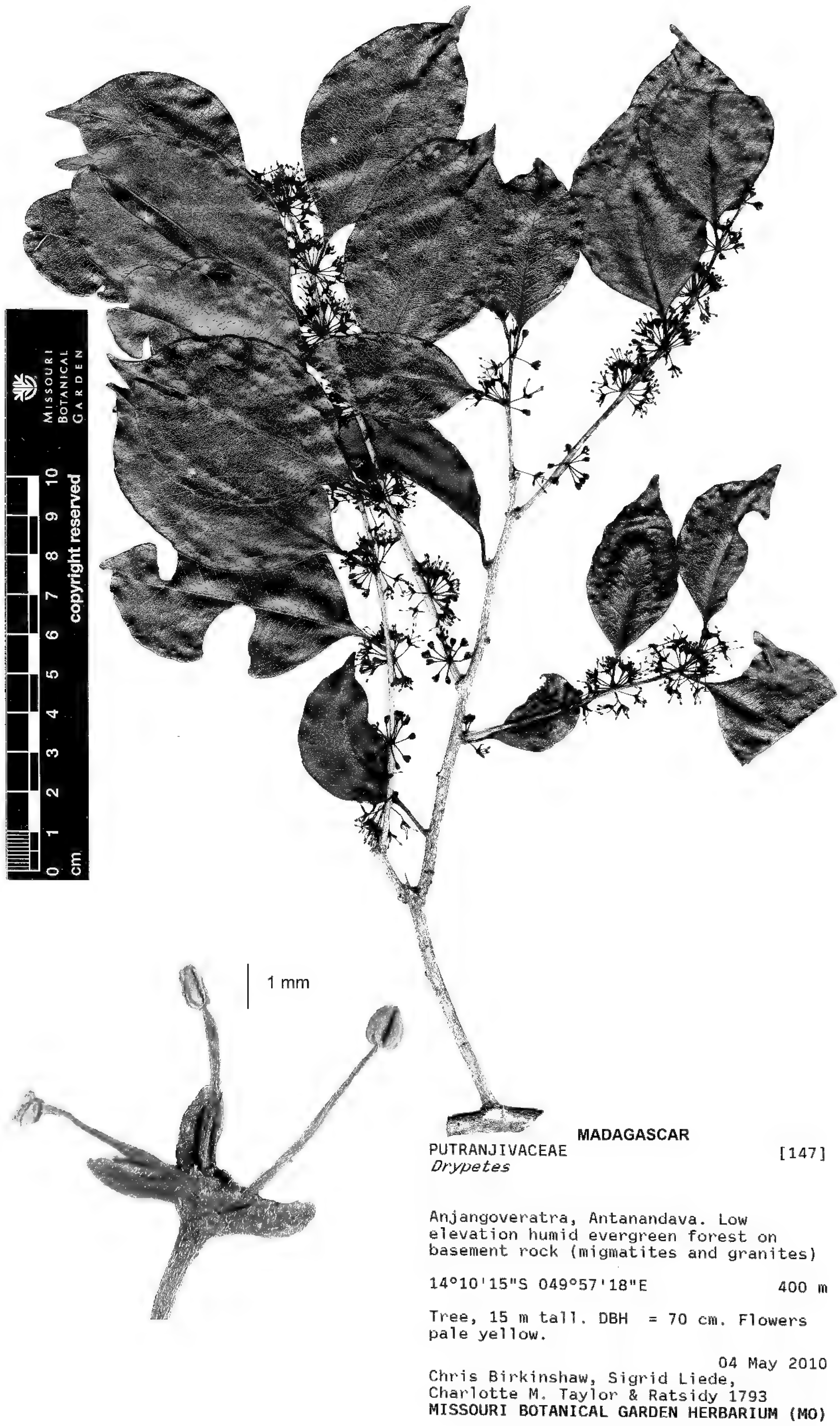


Figure 1. *Drypetes birkinshawii* McPherson, flowering branch with inset at lower left of staminate flower. Imaged from the holotype C. *Birkinshaw et al. 1793* (MO).

Discussion. Departing from such standard descriptions of the genus as those by Baillon (1858), Müller Argoviensis (1866), Pax and Hoffmann (1922), Leandri (1958), and Radcliffe-Smith (2001), which are consistent in stating that the staminate calyx comprises at least four sepals, *Drypetes birkinshawii* typically possesses only three (of over 200 flowers examined, only a single flower with four

sepals was seen). *Drypetes bathiei* Capuron & Leandri, *D. capuronii* Leandri, and *D. thouarsiana* (Baill.) Capuron, all Madagascan endemics, resemble the new species in this regard and demonstrate that a 3-parted calyx is far from unknown in the genus. This new species differs, along with *D. perrieri* Leandri, from the other Madagascan species of the genus in having rather small leaves (typically < 7 cm long in *D. birkinshawii*), non-pentamerous calyces, and a bicarpellate gynoecium. *Drypetes birkinshawii* can be separated from *D. perrieri* by the latter's staminate flowers, which are subtended by larger bracts (1.5 mm vs. < 0.5 mm) and which display four sepals and four stamens (vs. three of each in *D. birkinshawii*). They also differ in details of the indumentum, the youngest stems in *D. birkinshawii* being glabrous, as are the fruits, and the staminate sepals being only sparsely pubescent, whereas in *D. perrieri* the youngest stems are pubescent and the fruits and the staminate sepals are densely pubescent. *Drypetes madagascariensis* (Lam.) Humbert & Leandri (with a 5-parted calyx persistent in the fruit, and often with very spiny leaves) is the only other Madagascan species with an androecium of three stamens.

Paratypes. MADAGASCAR. **Fianarantsoa:** Forêt Classée de Manombo, bloc d'Analambotaka, forêt dense humide de basse altitude sur latérite, 75 m, 23°01′56″S, 47°42′07″E, 16 Nov. 2001 (fr.), *J. Rabenantoandro, G. McPherson,& Ratiana 784* (MO, P, TEF), 16 Nov. 2001 (fr.), *J. Rabenantoandro, G. McPherson, & Ratiana 800* (MO, P, TEF).

Acknowledgments. David Bogler and Fred Keusenkothen, both of MO, are thanked for their help in the production of Figure 1.

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Trifolium piorkowskii (Fabaceae, Papilionoideae), a New Clover from Shasta County, California, U.S.A.

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Abstract. A new species of clover is described, allied to *Trifolium fucatum* Lindl. and *T. depauperatum* Desv. *Trifolium piorkowskii* Rand. Morgan & A. L. Barber (Fabaceae, Papilionoideae) is an extremely rare clover that is apparently endemic to Shasta County, California, U.S.A. This new species differs from all other members of the *T. fucatum* complex in calyx and floral morphology, leaflet shape and markings, foliaceous stipules, and smooth seed coat. It also differs in range and habitat and has an eccentric nuclear ribosomal DNA ITS profile. *Trifolium piorkowskii* differs from the *T. depauperatum* complex in its relative robustness, leaf shape and markings, larger corolla size, the large acuminate involucre lobes, consistently forked calyx teeth, and larger seeds.

Key words: California, Fabaceae, IUCN Red List, Papilionoideae, *Trifolium*, U.S.A.

The *Trifolium fucatum* Lindl. complex is endemic to the lowland portions of the California floristic province. Despite its limited range and relative rarity, this group has proved to consist of a surprising number of discrete segregate taxa, each unique in ITS signature, morphology, habitat, and range. A study of this complex began in 1994, and it soon became clear that one of these segregates, *T. piorkowskii* Rand. Morgan & A. L. Barber, differed radically from all others in the group. The apparent sister-relationship of this species to the rest of the *T. fucatum* complex was later supported by a very distinctive ITS profile and by equally compelling morphological evidence based on a large-scale, common-garden study in 2008, in which over 100 accessions of *T. fucatum* s.l. were compared. *Trifolium piorkowskii* is described herein as a new species.

Trifolium piorkowskii Rand. Morgan & A. L. Barber, sp. nov. TYPE: U.S.A. California: Shasta Co., in a vernal pool, pasture field, ca. 250 yd. S of barn (& 300 yd. SW of barn), ca. 1/4 mi. S of Coleman Canal, 2.8 air mi. WSW of Darah Springs State Fish Hatchery, ca. 12 air mi. ENE of Cottonwood, 12 May 2003, *L. Ahart & J. Dittes 10151* (holotype, JEPS; isotypes, CDA, CHSC, HSC, MO, MU, UCSC). Figure 1.

Haec species *Trifolio fucato* Lindl. affinis, a quo stipulis foliaceis, foliolis medianis non profunde lobatis, calycis tubo elongato plerumque plus quam 10-nervi ac dentibus regulariter furcatis, corollae tubo magnopere inflato atque seminis testa laevi differt.

Glabrous annual clover, 7–20(–30) cm tall, erect or ascending, sparsely leafy, with 0 to 8 primary branches from base, rarely any secondary branches; stems ca. 5–15 cm (to 80 cm in cultivation), to 3.5 mm diam.; free portion of stipule lanceolate, herbaceous, entire, 1 cm; adnate basal portion of stipule with a dark purple spot. Petioles to 8(–12) cm, often with reddish blush distally; peduncles 5–15 cm, with reddish blush proximally and ca. equal to the subtending petiole. Leaflets 3, oblanceolate, at least those subtending the first inflorescence(s) shallowly 3- to 5-lobed and appearing erose; adaxial surface with a unique color pattern of faint pale stippling in distal 2/3; faint, thin, bicolored chevron near base; leaflets often developing a reddish wash extending from center toward margins but not obscuring the pale chevron (or entire leaf becoming red-purple on both surfaces when sun-stressed); largest leaflets to 2.8 × 1.9 cm; lateral veins ending in short marginal bristle. Inflorescences subglobose, with involucre 1.2–2.9 cm wide, with 3 to 16 flowers (generally 9 to 13) in 2 (1 to 3) whorls; involucre

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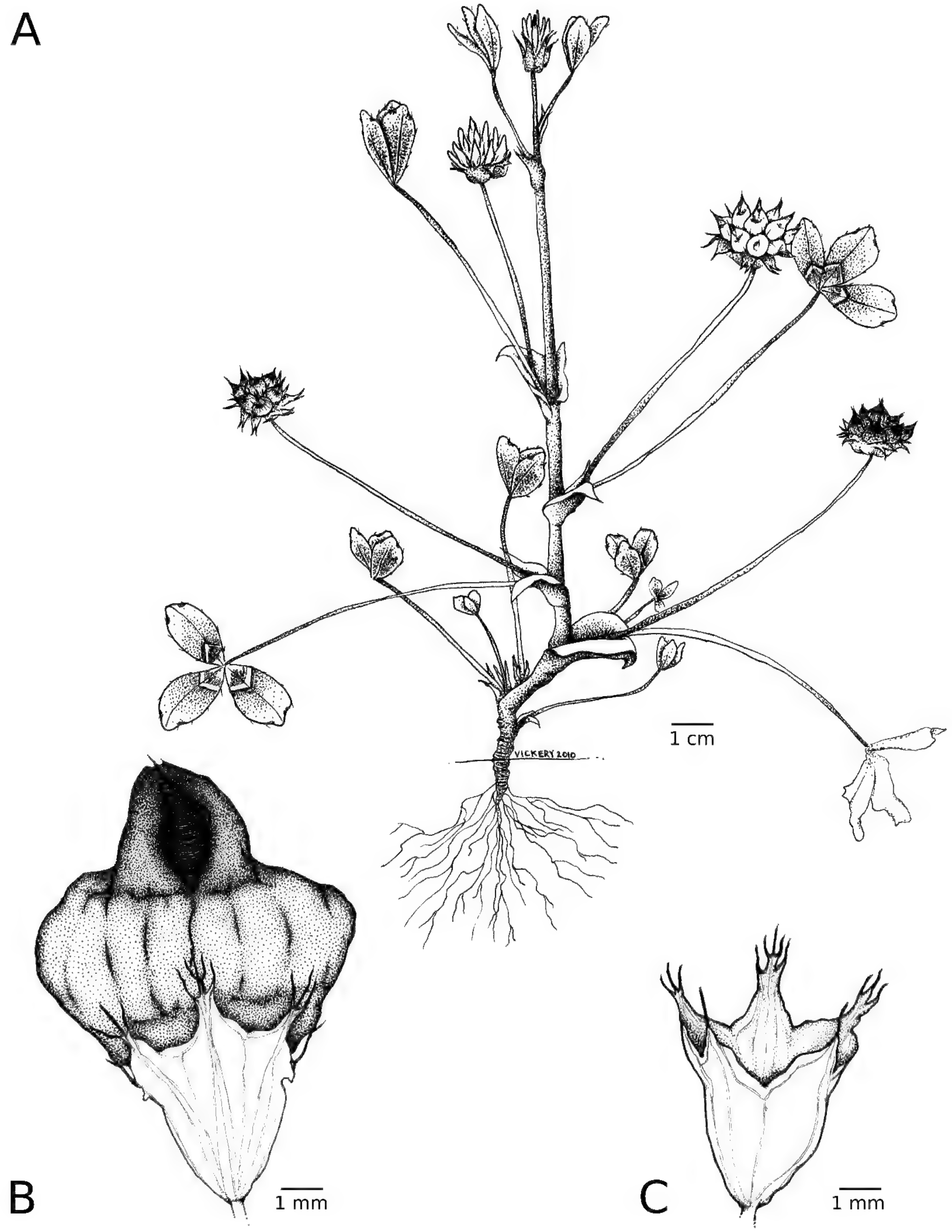


Figure 1. *Trifolium piorkowskii* Rand. Morgan & A. L. Barber. —A. Fertile habit. —B. Calyx showing teeth with floret removed. —C. Dry floret and calyx. Drawn from cultivated greenhouse plants (propagated from the type locality, *L. Ahart & J. Dittes 10151*), University of California, Santa Cruz, 2008.

consisting of 6 to 8 acuminate foliaceous lobes, entire-margined but often ± split at apex. Calyx membranous, campanulate, 5–8 mm; tube 2.5–4 mm, with 5 principal nerves and 5 to 9 faint intermediate nerves; calyx teeth 5, acuminate to linear, the 3 lower teeth 1–2.5 mm, each 3- to 5-forked and darker than the rest of the calyx, the upper 2 teeth shorter and often unbranched; flower buds pink in proximal 1/2, cream-colored in distal 1/2; corolla 1.1–1.3 cm, free distal portion ochroleucous at anthesis, the tube

portion pink or white depending on nighttime temperature, and much longer than the free banner; corolla tube partially enclosing the tiny wings and keel, the latter with an inconspicuous small pinkish spot on either side; style ca. 1.5 mm; ovules 2. Fruit a pod, 6 mm, including a 2 mm stipelike base, reticulately veined, translucent, indehiscent, remaining enclosed within the inflated corolla tube; seeds 0 to 2 per pod, 2.5 mm, gray-brown with blackish mottling; seed coat smooth.

Distribution and habitat. *Trifolium piorkowskii* occurs in the low foothills of the Cascade Range and upper Sacramento Valley in southern Shasta County and possibly in adjacent portions of Tehama County in northern California, at ca. 300–800 m. It occupies a habitat unlike that of any of the other *T. fucatum* segregates, preferring shallow vernal depressions on volcanic flats, or the banks of intermittent or perennial watercourses flowing through open rocky grassland, often with scattered blue oaks (*Quercus douglasii* Hook. & Arn.), or in transitional habitats with scattered chaparral and conifers at higher elevations. The species is evidently rare even within its limited range; the entire remaining population (of likely several thousand individuals) is currently known from two locations, one in the vicinity of the recently discovered type locality. While several herbarium specimens exist from other sites, Morgan and Piorkowski found no plants at any of these historical sites during searches in 1995 and 1996. At least one of the older collection sites was inundated by the Shasta Reservoir in 1941. A solitary plant was found at a new location off Ash Creek Road in 1997 (*R. Morgan 4951*). Seeds were collected from this plant and from plants at the type locality (UCSC seed accession numbers T414 and T413, respectively). Unlike most of its relatives, this species does not appear to occur in habitats subject to severe grass competition and, consequently, does not depend on grazing or other forms of periodic soil disturbance for its survival.

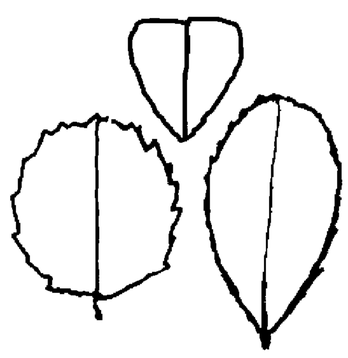
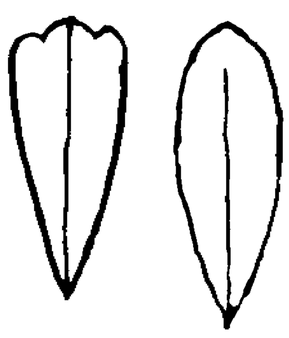
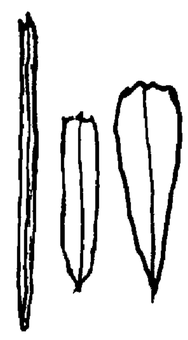
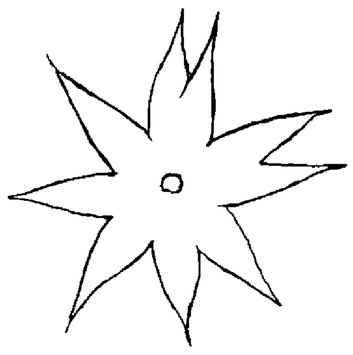
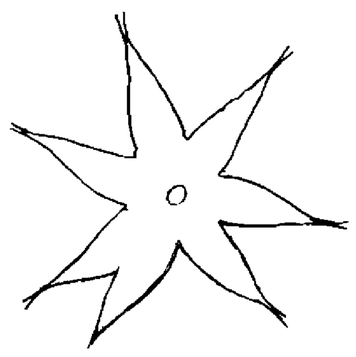
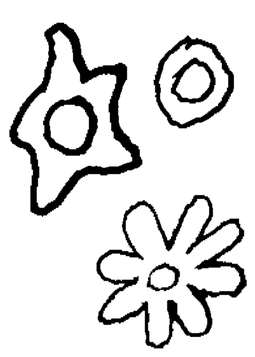
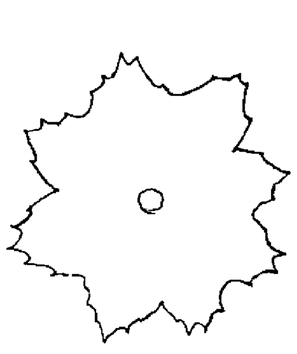
IUCN Red List category. *Trifolium piorkowskii* can be considered rare due to the very small and reduced number of locations. The habitat is vulnerable due to possible threats from livestock grazing, increasing human presence, and concomitant land-use changes. According to IUCN Red List criteria (IUCN, 2001) the new species is evaluated as Critically Endangered, qualified as CR B2bc(iii,iv,v). This assessment is based on the area of occupancy being estimated at less than 10 km^2; continuing decline in habitat, locations, and number of mature individuals; and likely extreme fluctuations in number of mature individuals (yearly fluctuations across several orders of magnitude are the norm for annual *Trifolium* L. species).

Phenology. *Trifolium piorkowskii* has been observed to flower in April and May. Flowers remain open only one day, after which the corolla tube becomes extremely inflated and retains its shape as it dries. Color is at first ochroleucous, then white (or uniformly soft pink if nights are chilly), eventually turning to pale tan and gradually to deep, rusty brown when dry, contrasting with the whitish calyx. The texture of the dry corolla is also distinctive, becoming tough, opaque, and papery rather than thin, translucent, and fragile as in other members of the *T. fucatum* complex.

Etymology. *Trifolium piorkowskii* is named in memory of Jeffrey M. Piorkowski (1961–2006), in gratitude for many years of assistance and support, including his assistance in locating this and other rare California clovers. Two vernacular names have been suggested: maverick clover in reference to the species' eccentric geographic range, morphology, and genotype; and marshmallow clover for the soft, inflated white flower heads.

Discussion. The differences between *Trifolium piorkowskii* and all other members of the *T. fucatum* complex are sufficient to place the new species in a basal or sister-clade relationship to the rest of the group. Of the many undescribed or unrecognized clover taxa known to the authors, this is easily the most distinctive species, both morphologically and genetically. In a large common garden experiment in 2008 and 2009, we measured 25 morphological traits in 102 accessions of *T. fucatum* s.l. from across California. In these trials, plants from our two accessions of *T. piorkowskii* exhibited a consistently unique suite of traits. The most conspicuously different features (exhibited in no other accessions) were the extreme inflation of the corolla tube, the elongated > 10-nerved calyx tube, foliaceous stipules, the regularly forked calyx teeth, the smooth seed coat, and the shallowly lobed middle leaves (see Fig. 1). Accessions of *T. piorkowskii* also exhibited statistically significant differences in phenology, leaf proportions and markings, cotyledon measurements, branching habits, floral markings, and measurements of inflorescence size (data from these trials to be published separately but available from the authors). The first collection of *T. piorkowskii* dates from 1894 (*Baker & Nutting s.n.*). Since that time, specimens of this species have been annotated with nearly every basionym available in the *T. fucatum* group (five

Table 1. Principal characters distinguishing four similar taxa of *Trifolium* L.

	T. fucatum s.l.	*T. piorkowskii*	*T. depauperatum* s.l.	*T. jokerstii*
Flower color at anthesis	white to yellow	white to pink	white to deep purple	golden yellow
Stems (max. diameter)	stout (4–8 mm)	intermediate (3.5 mm)	thin (2 mm)	intermediate (3 mm)
Indument	glabrous	glabrous	glabrous	calyx hairy
Stipules	± hyaline, entire	foliaceous, entire	foliaceous, entire	± hyaline, toothed
Lower calyx lobe	entire to irregular forks	regularly forked	entire	entire or forked
Calyx nerves	10	>10	5	5
Total teeth per calyx[1]	5 (rarely to 10)[2]	11 to 14	5	5 to 7
Calyx tube (mm)	1–2	3–4	ca. 1	4–5
Number of ovules	2 to 6[2]	2	2 to 6[2]	2
Relative seed size[3]	large (~3 mm)	large (~2.5 mm)	small (~1.5 mm)	large (~3 mm)
Seed coat	rough	smooth	lumpy or wrinkled	relatively smooth
Pod	dehiscent/indehiscent[2]	indehiscent	indehiscent[4]	indehiscent
Cotyledon blade[3]	long, broad 9–11 × 5.9–6.9 mm	long, narrow 8.7–11 × 4.4–5.6 mm	short, narrow	long, narrow
Cotyledon petioles[3]	short (4–13 mm)	long (12–18 mm)	unknown	long (13–25 mm)
Corolla size	medium to large 10–20 mm[2]	medium 11–13 mm	small 4.5–9 mm	medium 10–15 mm
Breeding system	selfing to outcrossing[2]	selfing	generally selfing	outcrossing
Leaflet shapes	 broad	 intermediate	 narrow	 intermediate
Involucre lobes	 large, acute, entire	 large, acute, split at tip	 small to vestigial	 large, toothed

[1] Total number of ultimate bristle-tipped divisions on all five calyx lobes.
[2] Dependent on the taxon.
[3] For *T. fucatum* Lindl. and *T. piorkowskii* Rand. Morgan & A. L. Barber, numbers are taken from common garden experiments; for *T. depauperatum* Desv. and *T. jokerstii* Vincent & Rand. Morgan, numbers are taken from the literature.
[4] With the exception of *T. depauperatum* var. *amplectens* (Torr. & A. Gray) Rattan.

basionyms have been published, all currently in synonymy under *T. fucatum*).

Two morphological variants are known for *Trifolium piorkowskii* that correspond to the two populations studied to date (Darah Springs and Ash Creek Road). Intra-taxon variability is nearly universal in California clovers, even among self-pollinating species like *T. piorkowskii*. These two forms differ markedly in cotyledon size, early stipule venation, phenology, and branching habit (one has a suppressed leader stem). This self-pollinating species is the only member of the *T. fucatum* complex to be consistently ignored by pollinating insects in common garden tests (other presumably selfing species have had occasional insect visits in these tests). Nevertheless, the potential for outcrossing is indicated by one case of hybridization, apparently with the large-flowered North Coast Range member of the *T. fucatum* complex (Middle Creek Station, 31 May 1905, *A. A. Heller s.n.* [UC] 631104; this site was subsequently flooded by the Shasta Reservoir).

Genetically, *Trifolium piorkowskii* differs from its nearest relatives at 13 to 28 bp positions within the ITS region, in contrast to the typical one to six positions (Ellison et al., 2006). In fact, the ITS data (supported by 67 further samples of *T. fucatum*) appear to suggest a closer relationship to the *T. depauperatum* Desv. complex, despite the over-

whelming morphological affinity with the *T. fucatum* complex. *Trifolium piorkowskii* thus may be seen as an evolutionary link between the two groups. Indeed, this close relationship between *T. fucatum* s.l. and *T. depauperatum* s.l. has long been recognized, both complexes sharing several specialized features that include inflated corolla tubes, very short calyx tubes, and roughened seed coats (interestingly, *T. piorkowskii* itself is the only exception to the last two of these characters). The *T. fucatum* and *T. depauperatum* complexes have been historically combined, first by Nuttall (1848) as *Trifolium* subsect. *Physantha* Nutt., later by Lojacono (1883) as *Trifolium* sect. *Physosemium* Lojac., then by McDermott (1910) as *Trifolium* sect. *Vesiculeae* McDermott. Nevertheless, *T. piorkowskii* keys readily in all references to *T. fucatum* (not *T. depauperatum*), and no collections have been annotated as *T. depauperatum*.

Some features of *Trifolium piorkowskii* are also similar to those of *T. jokerstii* Vincent & Rand. Morgan. Both are fairly small but showy annuals with open growth habit, long petioles and peduncles, relatively long calyx tube, inflated corolla, large, relatively smooth dark seed with black spots, and indehiscent pod with two ovules; both are narrow endemics of the upper Sacramento Valley in California. However, *T. jokerstii* has bright yellow, outcrossing flowers, a hairy calyx with larger teeth (only one of which is sometimes forked), variable leaf markings, lacinate fused involcre lobes, toothed stipules, and genetic markers that link it to the *T. barbigerum* Torr. complex. Table 1 details the differences between *T. piorkowskii*, *T. fucatum* s.l., *T. depauperatum*, and *T. jokerstii*.

Paratypes. U.S.A. **California:** Shasta Co., Shingle Creek, along Hwy. 44, ca. 1 mi. S along right-of-way of Pacific Gas Pipeline, 25 Apr. 1990, *D. W. Taylor 10668* (JEPS); Redding, 11 Apr. 1911, *J. W. Blankinship s.n.* (JEPS); Anderson, Wildcat Rd. & Ash Creek Rd., 7 May 1983, *W. S. Lennon s.n.* (CAS, JEPS, RSA); near Middle Creek Station, 31 May 1905, *A. A. Heller s.n.* (UC); Morley's Station, 22 May 1894, *M. S. Baker & F. Nutting s.n.* (UC).

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Una Nueva Especie de *Sloanea* (Elaeocarpaceae) del Alto Madidi en Bolivia

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Resumen. Se describe e ilustra una nueva especie del género *Sloanea* L. (Elaeocarpaceae) del Departamento de La Paz (Bolivia), Alto Madidi. *Sloanea gentryi* Pal.-Duque & C. M. Baeza está relacionada con *S. laxiflora* Spruce ex Benth., de la cual se diferencia por sus ramitas cuadradas y su fruto sin espinas.

Abstract. A new species of genus *Sloanea* L. (Elaeocarpaceae) is described and illustrated. The new species is known only from La Paz Department (Bolivia), Alto Madidi. *Sloanea gentryi* Pal.-Duque & C. M. Baeza is related to *S. laxiflora* Spruce ex Benth., from which it is distinguished by its quadrangular twigs and fruits without spines.

Key words: Alwyn Gentry, Bolivia, Elaeocarpaceae, Flora of Bolivia, IUCN Red List, *Sloanea*.

Sloanea L. (Elaeocarpaceae) incluye cerca de 150 especies distribuidas en los trópicos y subtrópicos (Smith, 2001). Las 101 especies neotropicales, se encuentran desde México hasta el sur de Brasil y en algunas islas del Caribe, en un rango altitudinal que oscila entre 0 y 2850 m.s.n.m. Estas especies generalmente presentan hábito arbóreo u ocasionalmente arbustivo, con o sin raíces tabulares; hojas alternas u opuestas, enteras, dentadas o sinuosas, con pecíolos alargados y bipulvinulados, y estípulas que pueden ser caedizas o persistentes. Inflorescencias axilares, racemosas o cimosas; las flores carecen de pétalos (98% de las especies del neotrópico); y los frutos capsulares presentan espinas cortas o largas, aunque en *Sloanea* subg. *Quadrisepala* Earle Sm., sect. *Corymbo-racemi* Earle Sm., y sect. *Paniculi* Earle Sm., algunas especies presentan cápsulas inermes (Smith, 1954; Alfaro, 1981; Steyermark, 1988; Smith & Steyermark, 1998; Smith, 2001). A continuación, se describe, discute e ilustra un nuevo taxón que por sus cápsulas inermes y carentes de un receptáculo persistente, es adscrito a *Sloanea* subg. *Quadrisepala* sect. *Corymbo-racemi*.

Sloanea gentryi Pal.-Duque & C. M. Baeza, sp. nov.

TIPO: Bolivia. La Paz: Alto Madidi, rd. ca. 7 km NE camp., 13°35′S, 68°46′W, 300 m, 27 May 1990 (fr.), *A. Gentry & S. Stensoro 70701* (holotipo, LPB; isotipos, F-2093518 no visto, MO-3850391, MO-5994645 no visto). Figuras 1, 2.

Haec species inter congeneros *Sloaneae* subgeneris *Quadrisepalarum* Earle Sm. sectionis *Corymbo-racemi* Earle Sm. a *Sloanea grossa* Earle Sm. capsula 2.6–3 cm alta ovoideo-globosa extus manifeste verruculosa valvis 2–3 mm crassis atque arillo 25-lobo; a *S. laxiflora* Spruce ex Benth. ramulis juvenilibus quadrangularibus, lamina foliari plana atque capsula inermi; a *S. lasiocarpa* Pittier capsula ovoideo-globosa extus glabra differt.

Árbol de 30 m de altura; raíces tabulares grandes; ramitas maduras 4–6 mm diám., marrón-grisáceas, teretes, levemente estriadas, glabras, escasamente lenticeladas; ramitas jóvenes cuadradas, 2–2.5 mm diám., cafés, glabras; yemas apicales cónicas, indumento fino y amarillento. Hojas alternas, laxamente agrupadas sobre las ramitas; estípulas no vistas, prontamente caedizas; pecíolos 1–3 cm × 1–1.5 mm, subteretes, superficie adaxial canaliculada, pubérula a glabra, superficie abaxial glabra a pubérula; 2 pulvínulos, negros, igualmente visibles, diferenciables del resto del pecíolo, estriados; láminas ovadas, cartáceas, 6.6–13 × 4.7–7 cm, base ligeramente redondeada, ápice acuminado, margen ondulado, sin dientes hacia el ápice, superficies abaxial y adaxial glabras; nervación broquidódroma; nervio principal resaltado y aplanado en la superficie adaxial, diminutamente pubérulo en la base, glabro hacia el ápice, en la superficie abaxial prominente, cuadrangular, glabro; 9 ad 12 nervios secundarios, ascendentes en ángulo de 45–65°, resaltados y glabros en la superficie adaxial, prominentes y glabros en la superficie abaxial; nervios terciarios paralelos a los secundarios, visibles en la superficie adaxial, glabros, en la superficie abaxial subprominentes, glabros; nervios cuaternarios poligonal-reticulados. Inflorescencias y flores no vistas. Infrutescencias terminales-subterminales. Frutos 1 ó 2; pedúnculo fructífero 4.8–6 cm × ca. 2 mm, café, estriado, con lenticelas abundantes, glabro;

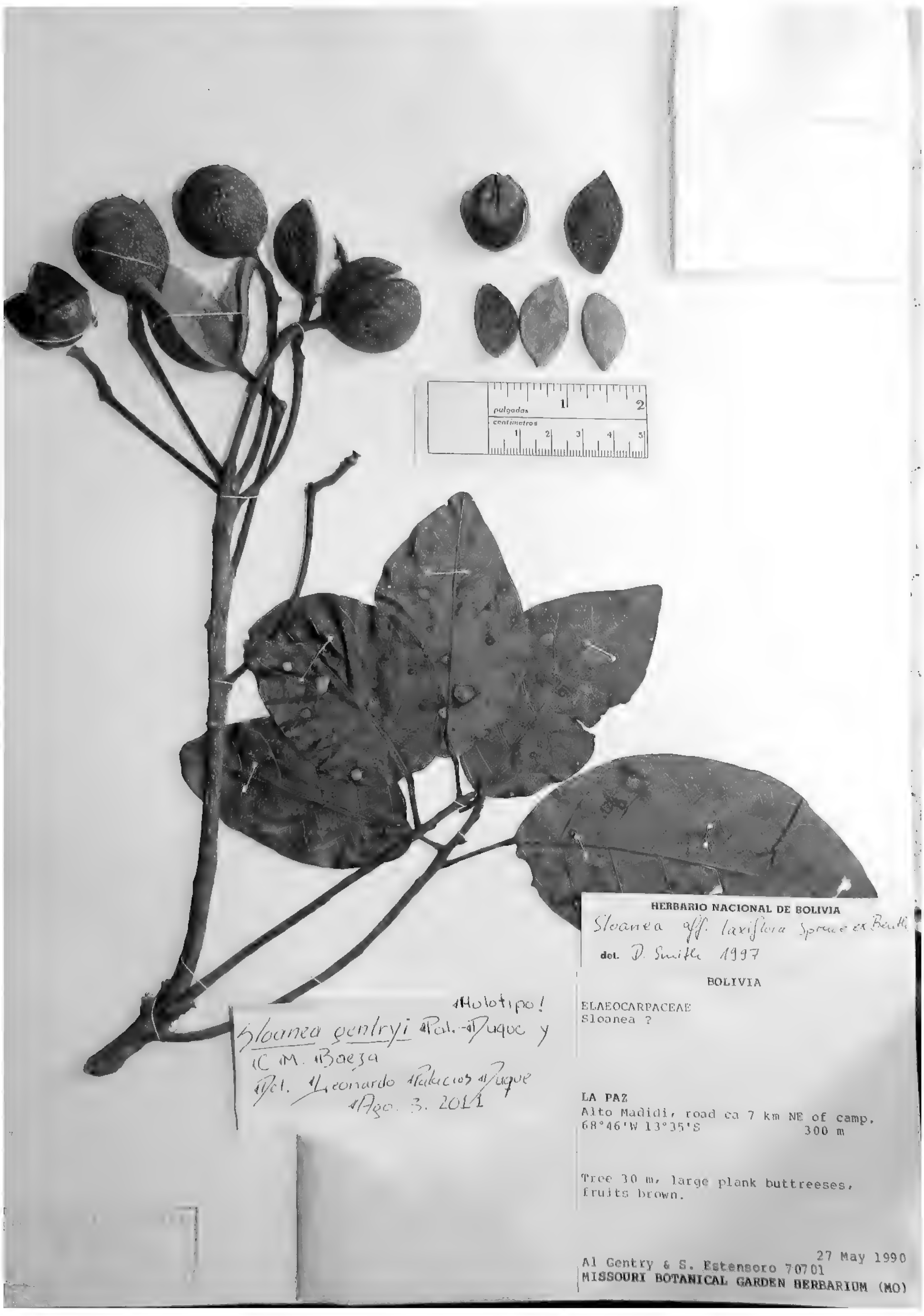


Figura 1. *Sloanea gentryi* Pal.-Duque & C. M. Baeza (*A. Gentry & S. Stensoro 70701*, holotipo LPB).

pedicelo fructífero ca. 1.4 cm × 2–3 mm, café, lenticelas abundantes, glabro-pubérulo; cápsulas de color marrón oscuro, ovoides-globosas, 2.6–3 × 2.5–3 cm, inermes, verruculosas, 2 a 4 valvas, 2–3 mm de espesor; semilla 1, ovoide-elíptica, 2.1–2.3 × 1.7–2 cm, parcialmente cubierta por el arilo; arilo carnoso, rojizo en material seco, 25 lóbulos, con márgenes uniformes.



Figura 2. *Sloanea gentryi* Pal.-Duque & C. M. Baeza. —A. Detalle mostrando las ramitas cuadrangulares, pecíolos canaliculados sobre la superficie adaxial base foliar ligeramente redondeada. —B. Cápsulas ovoides-globosas con superficie verruculosa. —C. Cápsula abierta mostrando una semilla parcialmente cubierta por el arilo y la unión de este a la cápsula. —D. Semilla recubierta por el arilo, unido a la calaza, y superficies externas e internas de las valvas. Todo del holotipo *A. Gentry & S. Stensoro 70701* (LPB).

Distribución y hábitat. Por el momento *Sloanea gentryi* solo es conocida de la colección tipo, realizada a 300 m.s.n.m., rango altitudinal que en la región del Alto Madidi corresponde al piso ecológico preandino, con presencia de un bioclima pluviestacional, caracterizado por una disminución considerable en las precipitaciones por la influencia de los anticiclones subtropicales durante el período invernal (Fuentes, 2005).

IUCN Red List category. Aunque se espera que *Sloanea gentryi* esté presente en una de las tres áreas protegidas de la región del Madidi, actualmente solo es conocida por la colección tipo y se desconocen datos sobre su abundancia, biología reproductiva y distribución. Lo anterior conlleva a que su estado de conservación sea asignado a la categoría DD o Datos Insuficientes de acuerdo con los criterios de la UICN (2001). Por consiguiente, se recomienda que en el área de colección se realicen nuevos inventarios y estudios poblacionales que permitan reevaluar el estado de conservación de la especie.

Etimología. En reconocimiento al distinguido botánico norteamericano Alwyn Howard Gentry (1945–1993), por los aportes que realizó al conocimiento de la flora de diferentes regiones del neotrópico, como en el Departamento del Chocó en Colombia y en Bolivia, país en el que efectuó la colección tipo de esta especie (ver <http://www.tropicos.org/Image/34998> y <http://www.tropicos.org/Image/35008>).

Discusión. Sloanea subg. *Quadrisepala* cuenta con 49 especies, de las cuales 16 presentan cápsulas inermes. En este grupo, *S. gentryi*, por la forma y dimensiones de sus hojas, se relaciona con *S. laxiflora*, aunque *S. gentryi* es fácilmente diferenciable por sus ramitas jóvenes cuadradas y glabras, y su fruto carente de espinas (Fig. 2A–D) (vs. ramitas redondeadas, pubérulas y cápsulas con espinas cónicas de hasta 1 cm de longitud en *S. laxiflora*). Por su cápsula verruculosa *S. gentryi* puede llegar a relacionarse con *S. lasiocarpa*, no obstante, el taxón aquí descrito es distinguible por sus cortos pecíolos de 1–3 cm (vs. 5.5–10 cm de longitud en *S. lasiocarpa*) y principalmente por la forma ovoide-globosa de sus cápsulas y la ausencia de indumento en la misma (vs. cápsula obovada con superficie pubérula y verruculosa en *S. lasiocarpa*). *Sloanea gentryi* también guarda relación con *S. grossa* Earle Sm., diferenciándose principalmente por presentar esta última especie pecíolos mucho más largos (9–12 cm vs. 1–3 cm en *S. gentryi*); cápsulas subglobosas, levemente verruculosas y el arilo de la semilla con cinco lóbulos (vs. cápsulas globosas, conspicuamente verruculosas y el arilo de la semilla con 25 lóbulos en *S. gentryi*). Aunque en *S. gentryi* las inflorescencias son desconocidas, el análisis de las cicatrices presentes en las infrutescencias, indica que la inflorescencia podría ser una umbela, lo cual, también permitiría separarla de *S. lasiocarpa*, *S. laurifolia* (Benth.) Benth., *S. laxiflora* y *S. subsessilis* D. Samp. & V. C. Souza con inflorescencias en panículas y racimos.

Clave para Separar a *Sloanea gentryi* de sus Congéneres Más Afines

1a. Hojas generalmente con el pecíolo negro; láminas con tendencia a ser conduplicadas; cápsulas con espinas cónicas de 1 cm de longitud, diminutamente pubérulas ..... *S. laxiflora*
1b. Hojas con pecíolos marrón; láminas planas (no conduplicadas); cápsulas inermes 2
2a. Cápsulas generalmente verdes con superficie lisa 3
2b. Cápsulas generalmente marrones con superficie verruculosa 4
3a. Árboles de 6–8 m; hojas opuestas, pecíolos de 0.2–0.4 cm ..... *S. subsessilis*
3b. Árboles de hasta 40 m; hojas subopuestas a alternas; pecíolos de 1.2–4 cm ..... *S. laurifolia*
4a. Cápsulas ovoides a globosas con superficie glabra 5
4b. Cápsula obovada de hasta 4 cm con superficie pubérula ..... *S. lasiocarpa*
5a. Cápsulas 2.5–3 cm, ovoides-globosas; superficie conspicuamente verruculosa; valvas 2–3 mm de grosor; arilo con 25 lóbulos ..... *S. gentryi*
5b. Cápsulas 4–5 cm, subglobosas, superficie ligeramente granulosa; valvas ca. 11 mm de grosor; arilo con 5 lóbulos ..... *S. grossa*

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A New Species of *Cybianthus* (Myrsinaceae) from Tobago and Venezuela

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ABSTRACT. *Cybianthus pittierianus* Pipoly & Ricketson (Myrsinaceae) is described from Tobago, and its taxonomic relationships are discussed. This species is often confused with *C. rostratus* (Hassk.) G. Agostini owing to its free portions of the filaments being longer than the anthers, and leaves with similar elliptic shapes and with petioles less than 1.2 cm. However, *C. pittierianus* is easily distinguished from *C. rostratus* by the former's leaf blade apices abruptly acute to short-acuminate (vs. long-acuminate to caudate), with secondary veins in 18 to 24 pairs (vs. 28 to 32 pairs), corollas 2.4–3 mm (vs. 2.1–2.5 mm), and corolla lobes chartaceous (vs. carnose) and adaxially glabrous (vs. densely glandular-granulose). *Cybianthus pittierianus* is known from the Coastal Cordillera of Venezuela and Tobago, in cloud forests on potassium- and magnesium-rich but nitrogen- and organically poor soils over metamorphic gneiss or schist rocks.

RESUMEN. Se describe *Cybianthus pittierianus* Pipoly & Ricketson (Myrsinaceae) como especie nueva para la ciencia y se discute su parentesco. Esta especie ha sido confundido con *C. rostratus* (Hassk.) G. Agostini debido a que las porciones apicales libres de sus filamentos son mas largas que las anteras, sus láminas elípticas con pecíolos menos que 1.2 cm de largo. Sin embargo, *C. pittierianus* se distingue fácilmente de *C. rostratus* por sus ápices foliares abrupte agudos hasta corto- acuminados (no largo-, ni caudados), nervios secundarios 18 a 24 (no 28 a 32) pares, corola 2.5–3 (no 2.1–2.5) mm de largo, con lóbulos corolinos cartáceos (no carnosos), y completamente glabros por dentro (sin gránulos glandulares). *Cybianthus pittierianus* se encuentra en la Cordillera de la costeña de Venezuela y en Tobago, en bosques nublados con suelos muy pobres en nitrógeno y elementos orgánicos; pero ricos en potásio y magnesio sobre rocas metamórficas de gneis o esquisto.

Key words: Caribbean biogeography, *Cybianthus*, IUCN Red List, Myrsinaceae, Tobago, Venezuela.

In our continuing work to produce accurate checklists and update our understanding of the systematic biology of *Cybianthus* Mart. (Myrsinaceae), we happened upon specimens first mentioned as a new species by Agostini in his dissertation (1972: 149–155, fig. 31) and subsequently reviewed by Pipoly in 1988 as he worked through collections at the Smithsonian Institution (US). While this species is easily recognized, the authors had not previously proposed its name in the hopes of finding pistillate flowering material, which, now after four decades, has not materialized. Therefore, in the interest of providing a name for this biogeographically interesting species, it is described herewith.

Cybianthus pittierianus Pipoly & Ricketson, sp. nov. TYPE: Tobago [Trinidad & Tobago]. Forest reserve, 16 Mar. 1911 (fl.), *W. Broadway 4051* (holotype, MO; isotypes, BM, BRIT, E, F, G [4], GH, L, NY, S, US, Z [2]). Figure 1.

Quoad laminas foliares ellipticas vel raro oblanceolatas usque obovatas et petiolos usque ad 1.2 cm longos, plerumque primo intuitu cum *Cybiantho rostrato* (Hassk.) G. Agostini confusus est, sed ab eo laminis abrupte acutis usque brevi-acuminatis (nec longi-acuminatis vel caudatis), nervis secundariis in 18 ad 24 (nec 28 ad 32) paribus, corollis 2.5–3 (nec 2.1–2.5) mm longis necnon lobis corollinis chartaceis (nec carnosis) intus glabris (nec dense glandulari-granulosis) praeclare et statim distinguitur.

Trees, 4–6 m tall; branchlets smooth, terete, 3–4 mm diam., moderately to densely appressed-lepidote. Leaves alternate; blades membranaceous to chartaceous, elliptic, rarely oblanceolate to obovate, 5.1–8.4 × 2.7–3.4 cm, apically abruptly acute to short-acuminate, acumen 0.6–1.4 cm, basally acute, decurrent on petiole; petioles slender, canaliculate, 0.8–1.2 cm, 0.8–1.1 mm in diam., densely appressed-lepidote; blades inconspicuously pellucid-punctate and punctate-lineate on both surfaces, glabrous adaxially, with scattered appressed-lepidote scales abaxially, midrib depressed adaxially, prominently raised abaxially, secondary veins obscure, in 18 to 24 pairs, inconspicuous on both surfaces, blade

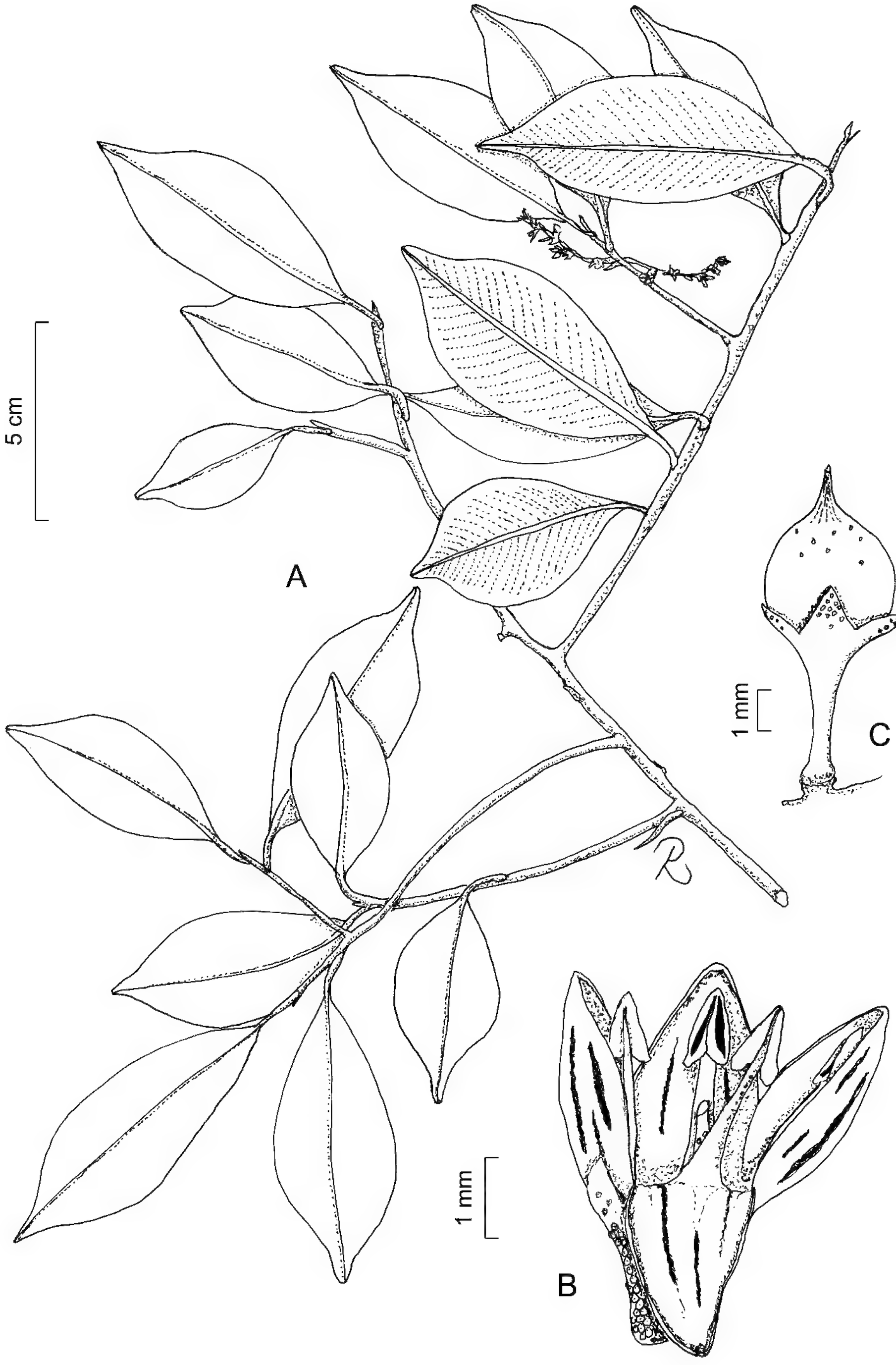


Figure 1. *Cybianthus pittierianus* Pipoly & Ricketson. —A. Branchlet. —B. Staminate flower. —C. Fruit. A, B drawn from the holotype, *W. Broadway 4051* (MO); C drawn from *J. Steyermark & R. Liesner 120737* (MO).

margins entire, flat, epunctate. Staminate inflorescence: raceme or panicle with 1 to 3 racemose branches from base, 2.4–2.6 cm, shorter than leaves, 6- to 10-flowered; rachis conspicuously punctate and punctate-lineate, densely lepidote; peduncles 0.3–0.5 cm, densely lepidote; inflorescence bract and inflorescence branch bract unknown; floral bract caducous, chartaceous, linear-lanceolate 1.1–1.3 ×

0.8–1 mm, apically acute, inconspicuously punctate and punctate-lineate, densely lepidote abaxially, margin entire; pedicels cylindrical, 0.5–0.7 mm, densely lepidote. Staminate flower 4-merous; calyx chartaceous, cotyliform, 0.8–1 mm, tube 0.1–0.2 mm, lobes ovate, 0.7–0.9 × 0.8–1 mm, apically acute, conspicuously pellucid-punctuate, sparsely lepidote abaxially, glabrous adaxially, margin entire, glabrous to lepidote; corolla yellow, chartaceous, campanulate, 2.4–3 mm, tube 0.8–0.9 mm, glabrous throughout, lobes ovate, 1.5–1.8 × 1.3–1.4 mm, apically acute to rounded, inconspicuously punctuate, glabrous throughout, margin entire, glabrous; stamens 2–2.2 mm, filaments 1.5–1.6 mm, adnate to corolla tube, staminal tube membranous, 0.5–0.6 mm, epunctate, glabrous, elobate, the apically free portion flat, 0.2–0.4 mm, anthers erect, ovate, 0.7–0.8 × 0.4–0.5 mm, apically acute, basally cordate, glabrous, dehiscent by wide slits, dorsifixed ca. 1/3 from base, connective prominently punctate; pistillode conic, 1.1–1.2 mm, 0.2–0.3 mm diam., densely and prominently punctuate, densely translucent lepidote, stigma punctiform, style 0.6–0.8 mm, ovary 0.4–0.5 mm, densely translucent lepidote, hollow. Pistillate inflorescence and flowers: unknown. Fruits depressed-globose, 6–7 × 7–8 mm, sparsely lepidote, endocarp verruculose externally; aril scanty, adnate to seed and endocarp; endosperm type I (Agostini, 1972: 118), embryo straight, ca. 4 mm.

Ecology and distribution. *Cybianthus pittierianus* occurs in the tropical moist montane broadleaf forests to the montane cloud forests of the Coastal Cordillera of Venezuela, which extends from the Yaracuy Depression eastward to the París Peninsula in Venezuela (Huber, 1997: 1, map 37; Olson et al., 2001: figs. 1–2; Bonaccorso, 2012: 1). The cordillera is adjacent to a geologically related formation in Trinidad and Tobago where soils have high potassium and magnesium but are nitrogen and organically poor, over metamorphic schist and gneiss material (Huber, 1997: 2). The flora of the islands is distinctly continental, especially that on the Northern Range of Trinidad and the Central Ridge of Tobago (White, 2009: 309; Armstrong, 2012: 1–2). The area is thought to have been formed under pressure during the movement of the Caribbean Plate and consequent flows of Orinoco, Amazon, and combined sediments along the northern continental shelf of Venezuela circling Trinidad and Tobago (Clayton et al., 1999: fig. 8) with simultaneous formation processes providing a basement structure of sediment fill in the eastern Venezuelan Basin and Antilles Forearc (Summa et al., 2003: fig. 4). The tectonic map provided by Gill et al. (2005: fig. 1) shows that the Coastal Cordillera of Venezuela and the islands of Trinidad and Tobago lie west of the Barbados Accretionary Prism and south of a deformation front that includes the South Caribbean Deformation Zone, La Blanquilla Thrust Belt, and the Tobago Forearc Basin, all accelerating southward from the Caribbean Plate against the South American Plate. It is, therefore, not a surprise that the geologically closely related metamorphic areas on the Atlantic Slope of the Coastal Cordillera and their counterparts on the northern slope of the Tobago Forest Reserve share such a unique species. *Cybianthus pittierianus* possesses a modern-day distribution that superposes the south-central base of the Aves Ridge, where lowlands are thought to have connected to the developing South American continent during the Late Eocene to the Early Oligocene (Iturralde-Vinent & MacPhee, 1999: fig. 6). The connection explained by Iturralde-Vinent and MacPhee (1999: fig. 6) was located north of their Orinoco Seaway and the Eastern Venezuelan Basin, immediately east of the Magdalena Basin.

IUCN Red List category. Given the paucity of collections, *Cybianthus pittierianus* cannot be evaluated and is thus assessed as Not Evaluated (NE), according to the IUCN Red List (2001) categories and criteria.

Etymology. This curious species is named for the Swiss-born, naturalized U.S. citizen Henri François Pittier (1857–1950). Dr. Pittier worked for the U.S. Department of Agriculture, exploring Central America for 14 years, and subsequently spent 31 years living in Caracas, Venezuela. As a geographer, engineer, and botanist, Dr. Pittier wrote a series of outstanding contributions to our knowledge of the floras of Costa Rica, Panama, Colombia, and Venezuela. His work in Venezuela included generalized keys to families, guides to useful plants, and a myriad of other basic works, including larger contributions toward a Flora of Venezuela.

Relationships. *Cybianthus pittierianus* is a member of *Cybianthus* subg. *Conomorpha* (A. DC.) G. Agostini based on its branchlets and calyx moderately to densely appressed-lepidote; its corolla campanulate and the adaxial surface glabrous; and its anthers longer than wide and apically acute, and dehiscent by wide longitudinal slits. With its elliptic, rarely oblanceolate to obovate leaves on relatively short petioles, *C. pittierianus* may at first be confused with another member of *Cybianthus* subg. *Conomorpha*, *C. rostratus*, an allopatric species from the Lesser Antilles. However, *C. pittierianus* may be

clearly and immediately distinguished from *C. rostratus* by the abruptly acute to short-acuminate (vs. long-acuminate or caudate) leaf apices, secondary veins in 18 to 24 pairs (vs. 28 to 32 pairs), corolla 2.4–3 mm (vs. 2.1–2.5 mm), and the chartaceous (vs. carnose) texture of the corolla lobes, which are glabrous (vs. densely glandular-grandulose) within.

Cybianthus pittierianus was first pointed out as a new species by Agostini (1972: 149–155, fig. 31) in his dissertation but was not formally described in an attempt to wait for better pistillate material. Given that over four decades have passed with no significant additional collections to fill that void, it was decided that it would be best to describe the species now and hope that its description alerts those managing the flora of the Venezuelan Caribbean coast and the reserves of Tobago of its presence and geographic significance.

Paratypes. TRINIDAD AND TOBAGO. **Tobago:** Tobago Forest Reserve, 7 Oct. 1912 (stam. fl.), *W. Broadway 3993* (L, S). VENEZUELA. **Carabobo:** Río San Gián, al sur de Borburata, entre La Toma y la cumbre de la fila por el sitio "Capuchinos," 750–1000 m, 16 Mar. 1911, *J. Steyermark & C. Steyermark 95218* (S). **Sucre:** Peninsula de Paria, Cumbre de Las Estrellas, W of Manacal, ca. 15 km, by air, NW of Irapa, E of El Sanche, N of El Paujil, 10°40′N, 062°40′W, 800–830 m, 30 Nov. 1979 (fr.), *J. Steyermark & R. Liesner 120737* (MO, VEN).

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Isoglossa glandulosissima (Acanthaceae, Ruellieae), a New Species from Southern Africa

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ABSTRACT. Material of a common and widespread species of *Isoglossa* Oerst. in southern Africa keys to *I. stipitata* C. B. Clarke in Clarke's 1901 taxonomic account in Flora Capensis. However, this material does not match either the type or the description of that species. Thus, a new species, *I. glandulosissima* K. Balkwill, is described for the Acanthaceae, Ruellieae. The critical distinction between *I. glandulosissima* and *I. stipitata* within the genus is the combination of a densely glandular bract with an acute tip that is either equal to or longer than the calyx in the terminal inflorescences. The new taxon occurs in a range of habitats, is not threatened, and is considered to be of Least Concern (LC) according to IUCN Red List criteria.

Key words: Acanthaceae, *Isoglossa*, IUCN Red List, Ruellieae, southern Africa.

Isoglossa Oerst. is a genus in which there are many taxonomic and nomenclatural difficulties, partly as a result of the marked morphological differences in inflorescences at various stages of development (Poriazis & Balkwill, 2008). A common and widespread species of *Isoglossa* in southern Africa, characterized by having dense glandular-tipped hairs on the bracts and calyx and by having a bract that is narrowly elliptic to narrowly ovate with an acute tip, keys to *I. stipitata* C. B. Clarke in Flora Capensis (Clarke, 1901). Clarke (1901: 82) describes the bract of *I. stipitata* as "obovate, obtuse with a short linear tip," which matches the *Krauss 302* specimen that he cites but not the *Flanagan 2322* specimen. *Isoglossa stipitata* should thus be lectotypified on *Krauss 302* (same principle as Articles 9.12 and 9.17(b) of the ICBN; Greuter et al., 2000), the holotype of *Rhytiglossa glandulosa* Hochst., which Clarke includes as a synonym of *I. stipitata*. *Isoglossa stipitata* is thus an illegitimate name.

Although Clarke indicates that he is only referring to part of the *Krauss 302* specimen (this because he has described some portions of the specimen as *Isoglossa grantii* C. B. Clarke), our field observations have shown that *Krauss 302* is unlikely to be a mixed gathering. We have seen a similar range of morphological variation on individual plants.

The second specimen that Clarke (1901) cites under *Isoglossa stipitata* is *Flanagan 2322* from near the Kei River in the Komgha Division; that specimen is part of *I. glandulosissima* K. Balkwill. Under *I. origanoides* (Nees) S. Moore, Clarke cites a Drège specimen from "Coast Region: Alexandria Div; in Johannas Kloof, between Enon and the Zuurberg Range, 1000–2000 ft."; that, too, is *I. glandulosissima*.

1. Isoglossa stipitata C. B. Clarke, Fl. Cap. (Harvey) 5(1): 82. 1901. TYPE: South Africa. Natal, in shady woods around Durban Bay, *Krauss 302* (lectotype, designated here, K).

2. Isoglossa glandulosissima K. Balkwill, sp. nov. TYPE: South Africa. Mpumalanga, ca. 34 km SE of Nelspruit, on farm Weltevreden 229JU (Pullen Farm), 23 Feb. 1989, *K. & M.-J. Balkwill 4287* (holotype, J; isotypes, E, K, MO, PRE).

Species nova *Isoglossa origanoidi* (Nees) S. Moore similis, sed ab ea bractea calyci aequali vel quam eo longiore, trichomatibus glandiferis magis quam eglandulatis et bracteis acutis (non acuminatis) differt.

Monocarpic herb or suffrutex, 0.3–1.5 m tall; immature stems with dense, short, eglandular trichomes, mature stems pubescent. Leaves slightly glaucous, ovate, 26–49 × 19–24 mm; with sparse, short, eglandular trichomes; apex acute; base round to cuneate; secondary veins 3 or 4; petiole 0–15 mm, hairy with short, eglandular trichomes. Leaves subtending terminal inflorescence ovate, 8–19 × 3.5–10 mm. Inflorescences predominantly terminal, not interrupted; terminal inflorescence 25–95 × 8–11 mm; bracts elliptic to ovate with dense, unicellular, eglandular trichomes and glandular trichomes with stalks of 3 or 4 thin-walled, unornamented cells, those at base of inflorescence 8–9.5 × 3–4 mm, those subtending flowers 6.5–10 × 6.5–9.5 mm; leaves

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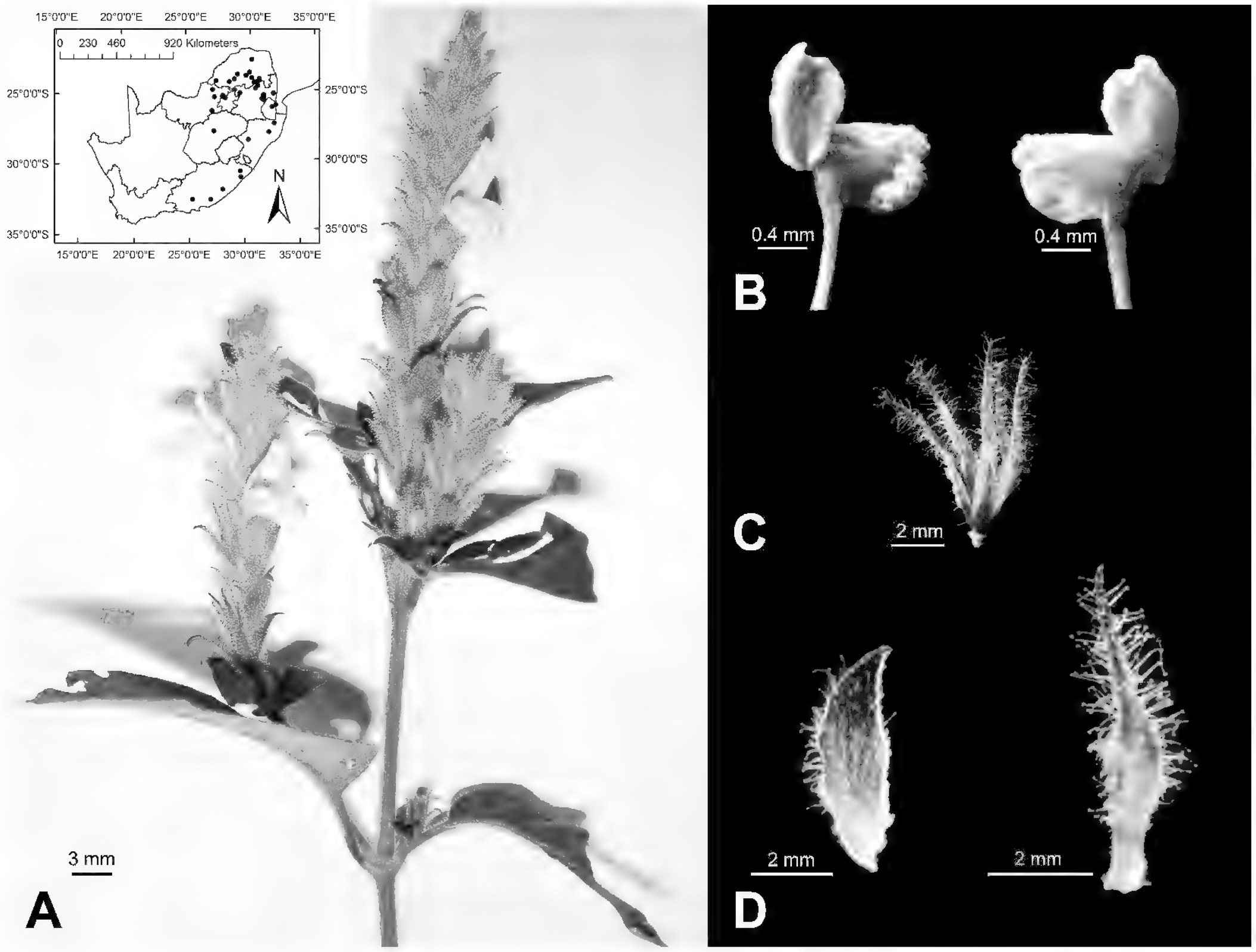


Figure 1. *Isoglossa glandulosissima* K. Balkwill. —A. Bilabiate corolla with equal adaxial and abaxial lips. —B. Two stamens with bithecous anthers, thecae held at right angles to the filament. —C. Calyx with dense glandular trichomes. —D. Bract of lateral inflorescence with prolific glandular trichomes. Photograph of *Poriazis s.n.* taken at Sugar Bush Farm, Hartebeesport, South Africa.

subtending lateral inflorescences ovate, 6–8.5 × 3.5–5.5 mm; lateral inflorescences 19–37 × 6–10 mm; bracts narrowly elliptic to narrowly ovate with dense, unicellular, eglandular trichomes and glandular trichomes with stalks of 3 or 4 thin-walled, unornamented cells, those at base of inflorescence 5.5–6 × 2.5–4 mm, those subtending flowers 6.5–7.5 × 2–3 mm; flowers 2 at a node. Sepals linear, densely viscous with gland-tipped trichomes of 3 to 4 cells long and unicellular, eglandular trichomes; at time of flowering 6.5–9 × 0.6–1.5 mm, at time of fruiting 9–10 × 0.4–1 mm; corolla white, bilabiate, adaxial and abaxial lips equal; corolla tube short, 5–6 × 2.5–3.5 mm; adaxial lip 5.5–7 × 2.5–4 mm, tip minutely bifid; abaxial lip 5.5–7 × 2.5–4 mm, trilobed, 2 lateral lobes clasping; midlobe cushioned, with palate of 5 to 7 marked ridges and maroon honey guides extending the entire length of the lip; stamens 2; anthers creamy white, held at right angles to the filament, close to one another; pollen girdled around the equator, grains ± 37.3 μm in diam.; style barely bifid. Capsule retinaculate, 4-seeded; seeds small, discoid, scabrous with tubercles and a notched hilum.

Distribution and habitat. *Isoglossa glandulosissima* is the most widely distributed of the southern African members of *Isoglossa*. It occurs along the coast of the Eastern Cape Province, in the midlands of KwaZulu-Natal and into the south of Mozambique. In the interior, it stretches from Swaziland and Barberton westward to central Free State and northward to North-West and the Soutpansberg in Limpopo Province (Fig. 1). *Isoglossa glandulosissima* is abundant along the south boundary of Limpopo and the northern boundary of Mpumalanga. This area falls under the Sudano-Zambezian phytogeographic region of southern Africa and is largely a subtropical area characterized as savanna biome with grassland and open woodland (Goldblatt, 1978; Werger & Coetzee, 1978; Mucina & Rutherford, 2006). *Isoglossa glandulosissima* occurs in the wooded areas. In drier areas of the country, the leaves are smaller, rougher, and appear slightly glaucous.

Table 1. Differences between *Isoglossa stipitata* C. B. Clarke, *I. glandulosissima* K. Balkwill, and *I. origanoides* (Nees) S. Moore. The characters for *I. woodii* C. B. Clarke are listed for *I. stipitata* as this name is a synonym for *I. woodii*.

	I. stipitata	*I. glandulosissima*	*I. origanoides*
Inflorescence	terminal and axillary, compact or interrupted	predominantly terminal, elongate, compact, densely glandular	relatively short
Number of veins on either side of leaf lamina	5 to 7	3 or 4	5 or 6
Bract shape	spathulate to obovate with a distinct acuminate tip (upside-down heart shape)	narrowly elliptic to narrowly ovate with an acute tip	lanceolate
Bract length on terminal inflorescence	generally equal to or longer than calyx	either equal to or longer than calyx	shorter than calyx
Calyx trichome type	eglandular and/or glandular trichomes	more glandular than eglandular trichomes	more eglandular than glandular trichomes with a white, hairy, densely fringed calyx

IUCN Red List category. *Isoglossa glandulosissima* is widespread and abundant in many of the areas in which it occurs and, thus, is classified as Least Concern (LC) according to IUCN Red List categories (IUCN, 2001).

Phenology. Flowering can occur at any time of the year, with a peak from autumn to winter. Field observations at Hartebeespoort (Poriazis & Balkwill, 2008) and at Rimer's Creek, Barberton (Balkwill, pers. obs.), confirm that plants do not flower every year, and that this species, like most others in the genus, is monocarpic with plants senescing at both localities in July or August.

Etymology. The specific epithet *glandulosissima* describes the extremely dense glandular trichomes found on both the bracts and calyces of this species (Fig. 1C, D).

Discussion. The predominantly terminal, elongate, compact, densely glandular inflorescence (Fig. 1A) together with the terminal bracts either equal to or longer than the calyx are diagnostic of this species (Table 1). In *Isoglossa origanoides*, the calyx is longer than the bracts and, generally, there are a greater proportion of eglandular to glandular trichomes than in *I. glandulosissima* (Table 1). *Isoglossa glandulosissima* can easily be differentiated from *I. prolixa* (Nees) Lindau, which has an interrupted inflorescence.

There is morphological variation within individuals and between populations. For example, *Balkwill et al. 5396* has both broadly elliptic and narrowly lanceolate bracts on the same individual. *Balkwill et al. 3773* from Blydeberg Nature Reserve and *Poriazis et al. 136* from Rimer's Creek, Barberton, exhibit hypertrichosis on the calyces. *Balkwill et al. 4294* has some peduncle visible between the flowers on successive nodes (collected on the road between Barberton and Kaapmuiden), whereas the majority of herbarium specimens and populations observed in the field have no peduncle visible between inflorescence nodes.

Paratypes. MOZAMBIQUE. **Maputo:** Goba to borderpost of Goba, ca. 3.5 km on rt. side of rd., 15 May 1975, *A. Marques 2766* (LMU); Ressano Garcia, 18 Feb. 1955, *A. W. Exell, F. A. Mendonca & H. Wild 475* (BM). SOUTH AFRICA. **Eastern Cape:** Port St. Johns, betw. Holy Cross & Bizana, Mtentu River, 9 Mar. 2000, *E. Cloete & A. Bok 5742* (J); Mkambati, 26 Jan. 1989, *T. J. Edwards et al. 3248* (NU); Komgha, along Kei River, Mar. 1894, *H. G. Flanagan 2322* (BOL, SAM); Alexandria, in Johannas Kloof, betw. Enon & Zuurberg Range, 1837, *Drège s.n.* (K); Grahamstown, Breakfast Vlei, 15 July 1943, *M. H. Giffen 7954* (UFH). **Free State:** Winburg, Willem Pretorius Game Reserve, 12 Apr. 1962, *O. A. Leistner 3027* (PRE). **Gauteng:** Pretoria, Fountains Valley, 24 Jan. 1929, *J. E. Repton 186* (TNU). **KwaZulu-Natal:** Umfolozi Game Reserve, 12 Feb. 1967, *C. J. Ward 6068* (NH, NU); Ubombo, Mkuzi Game Reserve, Stand 21, 7 Apr. 1977, *G. Goodman 1007* (NU); Weenen, Weenen Nature Reserve, Bosmans Rivierspoort Farm, 27 Jan. 1990, *K. Balkwill et al. 5396* (J); Muden Valley, 26 Jan. 1979, *E. E. Galpin s.n.* (BOL); 1.8 km on D568 off Muden-Weenen Rd., s.d., *Pienaar & Archer 1319* (PRE). **Limpopo:** Ben Lavin Nature Reserve, 10 June 1988, *K. Balkwill & Wits Biosoc 4103c* (J); Haenertsburg, 15 km from Haenertsburg on rd. to Pietersburg, 20 Apr. 1982, *K. Balkwill 129* (NU); Thabazimbi, Grootfontein Farm, 29 Apr. 1990, *K. Balkwill & M.-J. Balkwill 5824* (J); Nylstroom, Sterkrivierdam Nature Reserve, 11 Feb. 1972, *N. Jacobsen 2392* (PRE); 7.5 km from Nylstroom, on rd. to Vaalwater, 17 Feb. 1972, *Coetzee 955* (PRE); Zebedelia, Makapan near North Falls, May 1950, *B. Maguire M2737* (J); S end of Orrie Baragwanath Pass in Olifant's River Valley, 2 Apr. 1985,

K. Balkwill et al. 3019 (J); Lydenburg, beginning of Erasmus Pass, 18 Apr. 1960, *Strey 3280* (PRE); rd. from Ohrigstad to Hoedspruit, S end of Abel Erasmus Pass, 4 May 1983, *K. Balkwill 784* (J); at highest point of Abel Erasmus Pass, 16 Dec. 1987, *K. Balkwill & M.-J. Balkwill 5868* (J); Abel Erasmus Pass, 6 Apr. 1994, *P. M. Burgoyne 2408* (J); Abel Erasmus Pass, 2 May 1984, *K. Balkwill 1557* (NU); 20 km SW of Hoedspruit, Blydeberg Nature Reserve, 3 Oct. 1987, *K. Balkwill & M.-J. Cadman 3773* (J), 10 Oct. 1987, *3786* (MO); Pelgrimsrus, 7 Apr. 1941, *A. E. van Wyk 328* (BLFU). **Mpumalanga:** Loskop Dam Nature Reserve, 5 Mar. 1944, *A. O. D. Mogg 30447* (J); Nelspruit, Lowveld Bot. Garden, 23 Oct. 1969, *E. Buitendag 229*, 2 Mar. 1970, *436* (NBG); Kruger Natl. Park, Sitfungwane, 1947, *van der Schijff 1947*, Biyamiti River, 1953, *2183* (J); Pullen Farm, 23 Feb. 1989, *K. Balkwill 4287* (J); on rd. to Kaapmuiden Farm, s.d., *G. Germishuizen 5115* (PRE); Barberton, betw. Barberton & Kaapmuiden, 24 Feb. 1989, *K. Balkwill 4294* (J); Rimer's Creek, 27 Feb. 1889, *G. Thorncroft 75* (NU), 18 Mar. 2009, *D. L. Poriazis et al. 136* (J); Songimvelo Game Reserve, 2 Feb. 1999, *K. Balkwill et al. 10885* (J). **North-West:** Pilanesberg Game Reserve, 25 Feb. 1999, *T. F. Daniel & M. Butterwick 9366* (J); 3 km from Magatosnek on rd. to Olifantsnek Dam, 1 Mar. 1972, *B. J. Coetzee 1152* (PRE); Castle Gorge in Magaliesberg near Elandsfontein, 12 Mar. 1954, *A. D. J. Meeuse 9367* (NU); Hartebeespoort Dam, Rissik's Farm, 1906, *Leendertz 744* (BOL), 21 May 1995, *R. J. Sebola 270* (J); Potchefstroom, Dassiessrand, 1 Feb. 1939, *N. van der Westhuizen 536* (PUC). SWAZILAND. **Hhohho:** Pigg's Peak, Mar. 1960, *O. B. Miller 7214* (SRGH). **Lubombo:** Siteki (Stegi), 29 May 1963, *R. H. Compton 31623* (NBG).

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A New Species of *Liparis* (Orchidaceae, Malaxideae) from Nepal

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ABSTRACT. *Liparis langtangensis* B. B. Raskoti & Ale (Orchidaceae, Malaxideae) is a new species described and illustrated from Nepal. It is similar to *L. campylostalix* Rchb. f., sharing a cuneate corolla lip without a basal callus. *Liparis langtangensis* is distinguished by its oblanceolate leaf blades, the basal twisting of the ovary and pedicel, spreading or divericate lateral sepals, and a longer (to 5 mm) column, with two fleshy basal pads. Notes on the diagnostic characters used to distinguish it from allied species are provided.

Key words: Himalaya, IUCN Red List, *Liparis*, Malaxideae, Nepal, Orchidaceae.

Liparis Rich. s.l. (Orchidaceae, Malaxideae) comprises ca. 470 species (P. A. Ormerod, 2012, pers. comm.) widely distributed in tropical to temperate Asia, New Guinea, Australia, and the southwestern Pacific Islands, as well as subtropical and tropical America, North America, and Europe (Pearce & Cribb, 2002; Chen et al., 2009). Phylogenetic studies by Cameron (2005) suggested that *Liparis* s.l. sorted into two major clades, which might be further divided into four or more genera. His epiphytic clade comprised ca. 200 species that roughly subdivided into *Disticholiparis* Marg. & Szlach. (ca. 50 species) and *Stichorkis* Thouars (ca. 150 species). The remaining 270 taxa belonged to the terrestrial clade and may be divided into at least two genera, *Empusa* Lindl. and *Liparis*. Our new taxon belongs with the latter genus, which is characterized by the leaves being conduplicate (not plicate) and thinly fleshy.

In Nepal, *Liparis* is represented by 17 species (Press et al., 2000; Rajbhandari & Dahal, 2004; Rajbhandari & Baral, 2010). An unidentified *Liparis* was collected by Raskoti during an orchid survey in Langtang National Park in Rasuwa District, in central Nepal. Morphological characters of this material did not correspond to any described species of *Liparis*, and it is described below as new.

Liparis langtangensis B. B. Raskoti & Ale, sp. nov. TYPE: Nepal. Rasuwa Distr.: Kyangin Kharka, Langtang Natl. Park, 3700–3900 m, 26 July 2010 (fl.), *B. B. Raskoti 300* (holotype, KATH; isotype, TUCH). Figures 1, 2.

Diagnosis. This new species is similar to *Liparis campylostalix* Rchb. f., but differs by the leaves oblanceolate (vs. oblong to elliptic to ovate or lanceolate), peduncle cylindrical (vs. winged), the basal twisting of the ovary and pedicel, the lateral sepals spreading or divaricate (vs. parallel), and the column with two fleshy parallel basal pads (vs. one).

Terrestrial herb, 15–20 cm tall; pseudobulbs ovoid, 1–1.5 cm, enclosed by membranous sheaths. Leaves 2; petioles 3–4 cm, leaf base sheathing, oblanceolate, 4–5.5 × 1–1.5 cm, blade contracted into petiole, blade margin entire, blade apex acute to obtuse. Inflorescence 10–15 cm; peduncle 7–9 cm, cylindrical and green in lower 1/2 and light pink in upper 1/2; inflorescence rachis winged, 3–5 cm, lax, with 3 to 8 flowers; floral bracts triangular, 1 × 1 mm, apex acute. Flowers 1.5 cm diam., deep violet; pedicel and ovary 11–15 mm, twisted basally; dorsal sepal ligulate to lanceolate, erect, margins revolute, 8–10 × 1.8–2 mm, 3-veined, apex acute; lateral sepals spreading or divaricate, revolute, obliquely oblong to lanceolate, 6–7 × 1.7–2 mm, 3-veined, apex acute; petals deflexed, linear, 8–10 × 1 mm; corolla lip cuneate, clawed, 7–8 × 4–5 mm, lacking a callus, lip margin irregularly sub-erose, apex widely apiculate, emarginate, 5-veined, the 2 outer veins branching to the margins; column arcuate, 5 mm, basally dilated with 2 fleshy parallel thickened pads, the apex with subquadrate wings.

Habit and distribution. *Liparis langtangensis* is a terrestrial orchid in shrubland and is found growing in full shade on moist humus-rich slopes below *Rhododendron lepidotum* Wall. ex G. Don (Ericaceae). The new species is known only from the type locality in Nepal.

IUCN Red List category. *Liparis langtangensis* is only known from its type locality in central Nepal, and its distribution is limited to an area of ca. 2 km^2. In 2008, about 32 plants were observed at elevations from 3700 to 3800 m, but in 2009–2011 during the flowering time only 15 plants were observed. Overgrazing could be the major threat to the loss of this species. Again in 2012 and 2013, a greater number of plants were observed in the higher elevations at ca. 3900 m. It is strongly suspected

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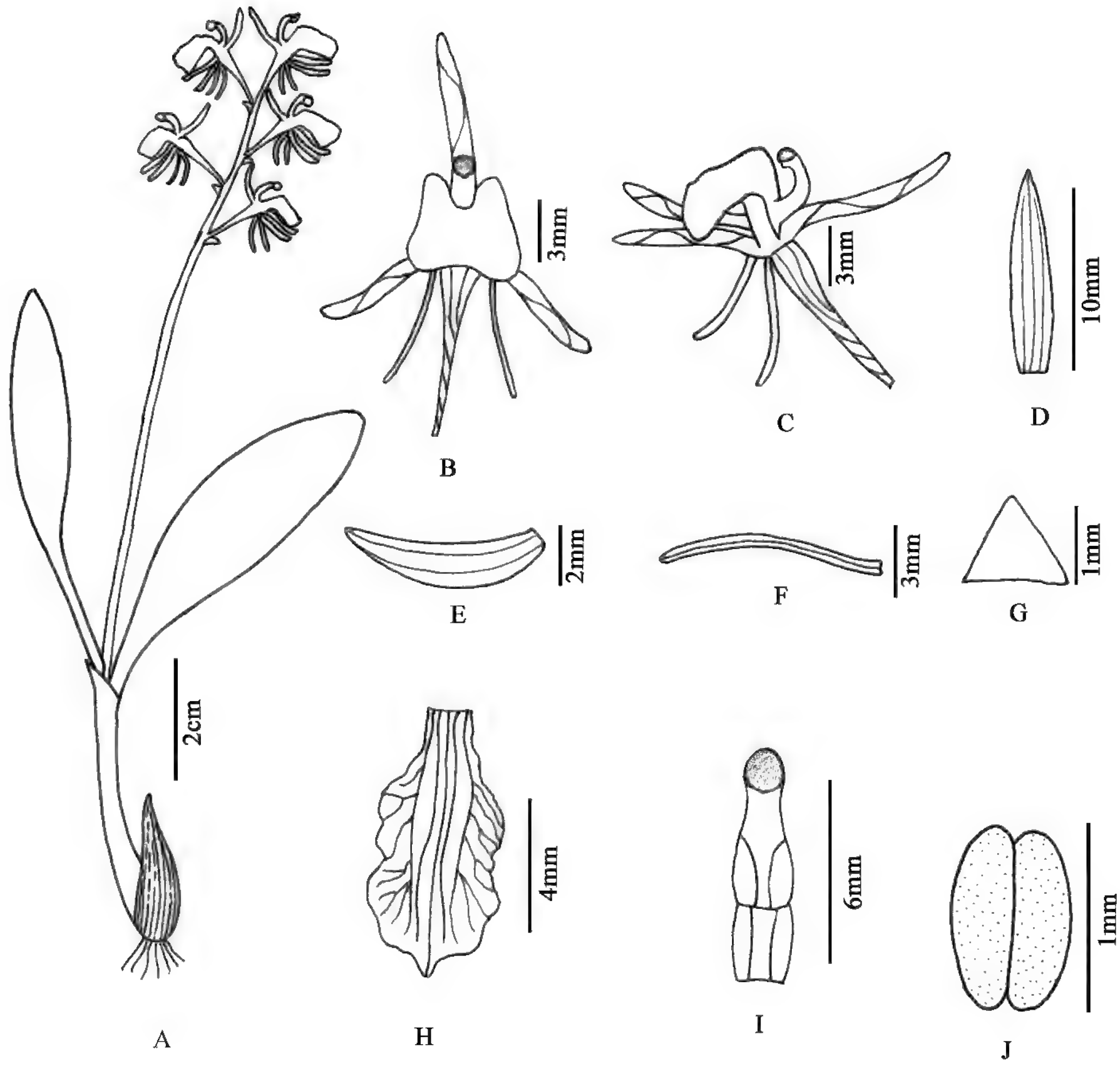


Figure 1. *Liparis langtangensis* B. B. Raskoti & Ale. —A. Flowering plant. —B. Flower, front view. —C. Flower, side view. D–J. Floral dissections. —D. Dorsal sepal. —E. Lateral sepal. —F. Petal. —G. Floral bract. —H. Corolla lip. —I. Column. —J. Pollinia. All drawn from the type specimen, *B. B. Raskoti 300* (KATH).

that the size of the population could be larger in that elevation. However, the extent of occurrence and the exact population size are unknown. For these reasons, *L. langtangensis* is assessed as Data Deficient (DD), according to IUCN Red List criteria (IUCN, 2012).

Phenology. The new species was observed to flower from July to August.

Etymology. The epithet *langtangensis* is taken from the type locality, from Langtang National Park in Nepal. This park is the first Himalayan national park in Nepal, which was established in 1976 and shares its northern border with the Xizang Autonomous Region in China.

Taxonomic discussion. *Liparis langtangensis* is morphologically similar to *L. campylostalix*, with which it shares a corolla lip that is cuneate and lacks a basal callus (Chen et al., 2009). The new species is further distinguished from *L. campylostalix* by leaf blades that are oblanceolate (vs. oblong to elliptic to ovate or lanceolate); the peduncle is cylindrical (vs. winged); the ovary and fertile pedicel are much twisted (vs. no twisting); the lateral sepals of the flowers are spreading or divaricate under the lip (vs. parallel); and the column is slightly longer (to 5 mm vs. 2.5–4 mm), with two fleshy parallel basal pads (vs. a single solid base). The distribution pattern of the two species also distinguishes them from each other. *Liparis langtangensis* is assumed to be endemic to Nepal, whereas *L. campylostalix* is widely distributed across 15 provinces and autonomous regions in China (not reported primarily from the south), and also extends to Korea, Japan, and the Russian Far East. It is reported from forests and grasslands at elevations of 1100–2800(–3400) m (Chen et al., 2009). In contrast, the new species was collected at higher elevations, from 3700 to 3900 m.

Liparis rostrata Rchb. f. is superficially similar in that it shares a lip without a basal callus and dilated

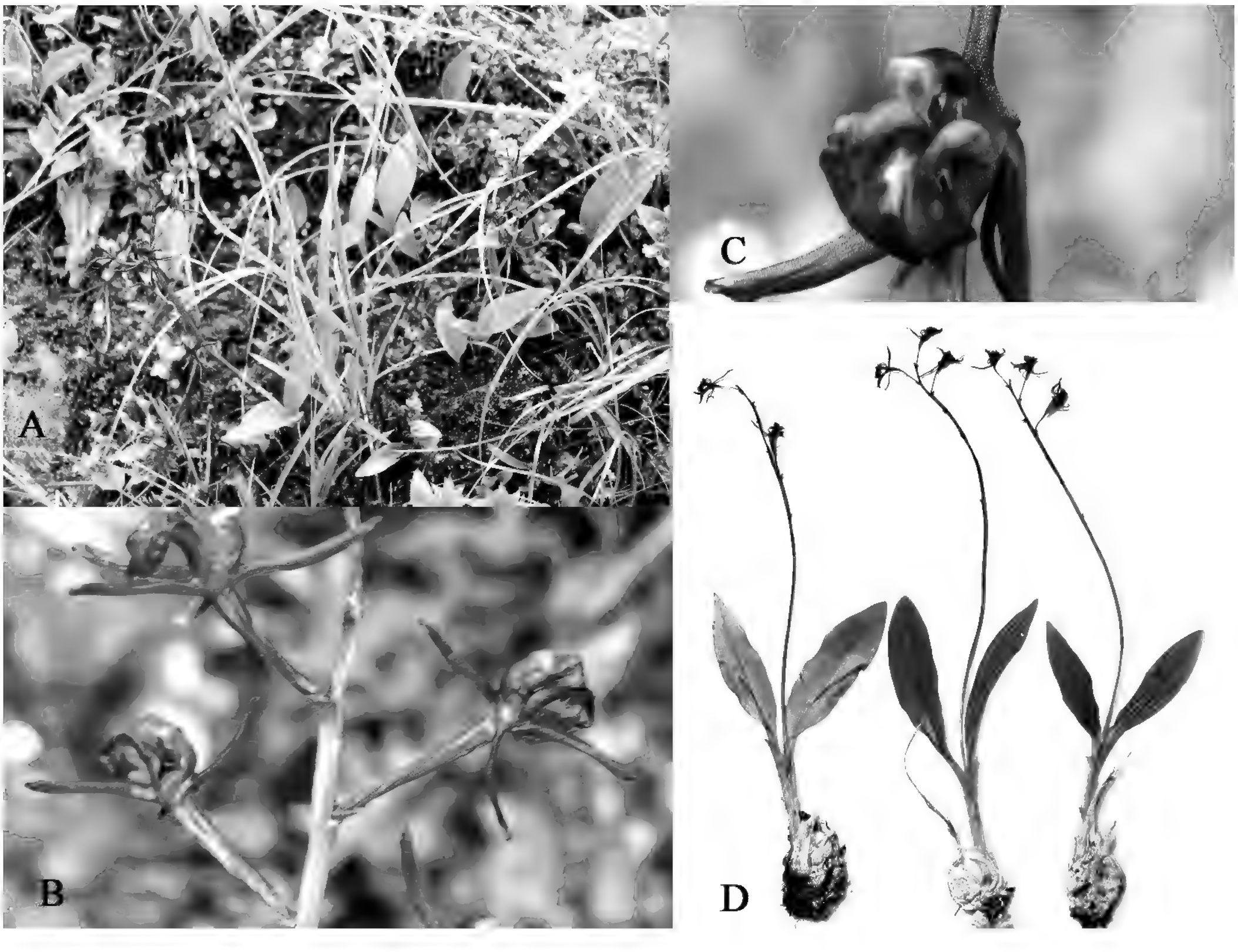


Figure 2. *Liparis langtangensis* B. B. Raskoti & Ale. —A. Habitat, with four fertile and several younger plants visible. —B. Close-up of inflorescence. —C. Two anthesal flowers appear in the foreground. —D. Material of the type specimen. All photographs were taken by the first author at the type locality in Langtang National Park in Nepal.

base of the column. However, this differs from *L. langtangensis* in having an obovate corolla lip and the column with two toothlike basal projections. *Liparis rostrata* is reported from *Tsuga* (Endl.) Carrière forests in valleys, 2600–2700 m, from southern Xizang and Yunnan in China, and from northern Nepal. It occurs from lower altitudes than those of the new species in Nepal.

Acknowledgments. The authors wish to express sincere thanks to Paul Ormerod, Cairns, Queensland, Australia, for his valuable suggestions during the manuscript's preparation.

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A New Combination in *Ardisia* (Myrsinaceae) from Vietnam

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Abstract. The lectotypification of *Ardisia tinctoria* Pit. and subsequent reidentification of the type material as *A. quinquegona* Blume subsp. *quinquegona* resulted in two collections being orphaned under the name *A. tinctoria* var. *microcarpa* Pit. We elect to elevate the variety name *A. tinctoria* var. *microcarpa* and, here, propose the following new combination, *A. microcarpa* (Pit.) Ricketson & Pipoly, comb. et stat. nov., to accommodate these orphaned collections.

Resumen. Cuando se dieron cuenta el hecho de que *Ardisia tinctoria* Pit. es sinónimo de *A. quinquegona* Blume subsp. *quinquegona*, unas colecciones fueron dejadas como huérfanas bajo el nombre *A. tinctoria* var. *microcarpa* Pit. Para poder acomodar a esas colecciones, se reconoce una entitad para incluir a ese material huérfano bajo una nueva combinación y estatus, *A. microcarpa* (Pit.) Ricketson & Pipoly.

Key words: *Ardisia*, Myrsinaceae, Vietnam.

Pitard (1930: 817–818) described the new species *Ardisia tinctoria* Pit. based on four syntypes all at Paris (P): "Annam: Dac-kiet, prov. de Thanh-hoa [*Poilane 1841*]; Lang-khoac, prov. de Quang-tri [*Poilane 1370*]; route de Nha-trang à Ninh-hoa (*Poilane* [*8303*]); Hué (*Squires* [*360*])." Unfortunately, Pitard did not list either collector names or numbers in his manuscript, but these collections have been verified by the authors and are still present in the herbarium at P. Pitard (1930: 818) also described the variety *A. tinctoria* var. *microcarpa* Pit. based on 10 syntypes all at P: "Tonkin: bois de Cophah, entre Hanoï et Bac-ninh [*Balansa 4608*]; vallée de Langkok [*Balansa 3921*], au mt. Bavi (*Balansa* [*3924*, *3925*]); bois de Nam-dinh (*Mouret* [*368*]); vers Ninh-binh (*Bon* [*1389*]); réserve forestière de Chanmong, prov. de Phu-tho (*Chevalier* [*32225*]); Choganh (*Pètelot* [*895*]). – Laos [Vietnam]: Cahn-trap (*Spire* [*1135*, *1354*])."

In 1996, Imkhanitskaya published a series of articles indexing the type material located in the herbarium of the Komarov Botanical Institute in St. Petersburg (LE). Imkhanitskaya (1996: 40) lectotypified *Ardisia tinctoria* with *R. Squires 360* [lectotype, P; isolectotype, LE], using only the material available to him at LE and without studying any of the other syntypes, which are all available at P. It also appears that Imkhanitskaya did not view any of the syntypes associated with *A. tinctoria* var. *microcarpa*.

In 2004, Hu published the Myrsinaceae for the *Flore du Cambodge du Laos et du Vietnam*, after an exhaustive study of much of the southeastern Asian material. Hu (2004: 56–62) determined that the syntypes of *Ardisia tinctoria* represent three different species. *R. Squires 360* and *E. Poilane 8303* are actually specimens of *A. quinquegona* Blume var. *quinquegona*; *E. Poilane 1841* is a paratype of his new species *A. applanata* C. M. Hu & J. E. Vidal; and *E. Poilane 1370* represents true *A. tinctoria*. Hu incorrectly lectotypified *A. tinctoria* on the basis of the material of *E. Poilane 1370* at P, apparently unaware of the earlier work by Imkhanitskaya (1996). In addition, Hu (2004: 56–61) determined that the syntypes of *A. tinctoria* var. *microcarpa* represented five separate entities: *B. Balansa 4608* = *A. depressa* C. B. Clarke; *Bon 1389*, *M. Mouret 368*, *C. Spire 1135*, *1354* = *A. quinquegona* var. *quinquegona*; *A. Chevalier 32225* = *A. quinquegona* var. *latifolia* Pit.; *B. Balansa 3921*, *3924*, *3935* = *A. quinquegona* var. *hainanensis* E. Walker; *A. Pètelot 895* = *A. tinctoria*. Hu (2004: 61–62) designated *A. Pètelot 895* as the lectotype of *A. tinctoria* var. *microcarpa*.

Because Hu (2004) overlooked the earlier valid lectotypification of *Ardisia tinctoria*, which rendered that name a synonym of *A. quinquegona* subsp. *quinquegona*, *A. Pètelot 895* and *E. Poilane 1370* represent an entity without a name. To resolve this problem and accommodate these orphaned collections, we elect to elevate the varietal name *A. tinctoria* var. *microcarpa* to species.

Ardisia microcarpa (Pit.) Ricketson & Pipoly, comb. et stat. nov. Basionym: *Ardisia tinctoria* Pit. var. *microcarpa* Pit., Fl. Indo-Chine (Lecomte) 3(7): 818. 1930. TYPE: Vietnam. Ninh Binh: Giap Ha, env. de Cho Ghênh (Cho Ganh), Apr. 1923, *A. Pételot 895* (lectotype, designated by Hu [2004: 61], P; isotypes, P [2]).

Additional material. Vietnam. **Quang Tri:** Lang-khoac [Lang Khoai], 10 Apr. 1920 (fl), *E. Poilane 1370* (syntype of *Ardisia tinctoria*, NY, P).

Acknowledgments. This project was aided greatly by the availability of herbarium images and data online. We deeply appreciate the ability to have public access to the information of the following institutions: The New York Botanical Garden Herbarium (NY) (<http://sciweb.nybg.org/Science2/hcol/vasc/index.asp>) and the Herbarium Musei Parisiensis (P) (<http://coldb.mnhn.fr/colweb>). Finally, we appreciate the availability of the Biodiversity Heritage Library, an outstanding project which is "a consortium of natural history and botanical libraries that cooperate to digitize and make accessible the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global biodiversity commons" at <http://www.biodiversitylibrary.org>.

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Lectotypification of *Ardisia dawnaea* (Myrsinaceae)

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Abstract. A taxonomically complex issue regarding *Ardisia gracilis* Lace, *A. dawnaea* C. E. Parkinson, and *A. dawnensis* M. P. Nayar & G. S. Giri (Myrsinaceae) from Burma [Myanmar] is discussed and resolved with the lectotypification of *A. dawnaea*.

Resumen. Se resuelve una situación complicada y confusa entre tres especies Birmania: *Ardisia gracilis* Lace, *A. dawnaea* C. E. Parkinson y *A. dawnensis* M. P. Nayar & G. S. Giri (Myrsinaceae), por lectotipificar a *A. dawnaea*.

Key words: *Ardisia*, Burma [Myanmar], Myrsinaceae.

Recent studies within the genus *Ardisia* Sw. have revealed a complex series of taxonomic mistakes that have taken place over the last century. This short note is intended to finally resolve one of these issues, including the lectotypification of *A. dawnaea* C. E. Parkinson.

Ardisia dawnaea C. E. Parkinson, Indian Forester 60: 266. 1934, replacement name. Replaced syn.: *Ardisia gracilis* Lace, Bull. Misc. Inform. Kew 1914(4): 153–154. 1914, nom. illeg., non *Ardisia gracilis* Miq., Fl. Bras. 10: 287, t. 33. 1856. TYPE: Burma [Myanmar]. Kayin: Amherst Distr., below Mulai-Tit Peak, Dawna Range, 3500–6000 ft. [1067–1829 m], 27 Jan. 1912, *J. Lace 5624* (lectotype, designated here, E [barcode] E00413551; isolectotypes, CAL, K).

Ardisia dawnensis M. P. Nayar & G. S. Giri, Bull. Bot. Surv. India 27(1–4): 222, fig. on p. 223. 1985 [1987]. TYPE: Burma [Myanmar]. Kayin: Amherst Distr., below Mulai-Tit Peak, Dawna Range, 3500–6000 ft. [1067–1829 m], 27 Jan. 1912, *J. Lace 5624* (holotype, CAL; isotypes, E, K).

Miquel (1856: 287) described material from Colombia, validly establishing the name *Ardisia gracilis* legitimately. Unfortunately, Lace (1914: 154) would later use the same epithet when describing material from Burma [Myanmar], with three syntypes, "Indo-China. Burma: Tenasserim, Dawna Range, 1050–1800 m., *Lace 4627*, *5624*, *Beddome 114*," without a single element identified as type. Although the name was validly published by Lace, it is illegitimate, blocked in *Ardisia* by the priority of Miquel's earlier epithet. Parkinson (1934: 266) corrected Lace's error, "Lace in naming the Mulayit plant overlooked the fact that the trivial name *gracilis* had already been given by Miquel to a Brazilian plant," but failed to unambiguously identify a type for his replacement name *A. dawnaea* by citing three or four collections "Mulayit, *Beddome*, *Lace* [it is unclear if he means both Lace numbers], *Parkinson*." Both Beddome and numbered Lace collections were earlier used by Lace in 1914; Parkinson ambiguously mentioned these syntypes, although the Parkinson collection would not be syntypic. Thus, the nomen novum is valid, but the species name is still ambiguously typified. According to Kanchi Gandhi (pers. comm., 2012) "the nom. nov. is valid, but the name is not typified ... for new combinations and new names, typification is not mandatory" because both are "typified by the type of the basionym/replacement synonym," respectively (cf. Articles. 7.3, 7.4, McNeill et al., 2012). Finally, independently and apparently unaware of the above transactions, Nayar and Giri (1985 [1987]) described a new species, *A. dawnensis* from the *J. Lace 5624* collection at CAL. They list two additional specimens as "Specimens other than type:" a collection without collector or number, collected on 22 Feb. 1909 [which is the same day and general location as *J. Lace 4627*] and a gathering by *G. Gallatly 281 A–E*. Unfortunately, they do not indicate where either of these specimens is currently housed. Nayar and Giri make no reference to any other material, or to either of the names published by Lace or Parkinson. Although Nayar and Giri's species name was validly published, it corresponds taxonomically to the material earlier considered by both Lace and

Parkinson and, thus, is placed in synonym under *A. dawnaea* which has priority. It should be noted that Larsen and Hu (2001: 147) were the first to place *A. dawnensis* in synonym under *A. dawnaea* in their work related to the Flora of Thailand, but also failed to unambiguously indicate a type for *A. dawnaea*.

Thus, our intention here is to clarify a complex taxonomic issue and to finally designate a lectotype based on the original three collections mentioned by Lace in 1914. Fortunately, all the original material is still available. Although we have not seen the material at CAL, we know from Nayar and Giri (1985 [1987]) that a specimen of *J. Lace 5624* is present [the holotype of *Ardisia dawnensis*] and the original drawing of the material used in the manuscript indicates a good quality sheet. We also could assume that the material mentioned by them (Nayar & Giri, 1985 [1987]: 223) as "Dawna range, Thatan dist., Burma, 4500 feet (1215 m), 22 Feb. 1909" is that of *J. Lace 4627*, because the collection information is essentially the same; we cannot be certain, and no information on where the specimen is housed is given. We reject both of these specimens as candidates for lectotypification to avoid confusion with the holotype designation of the *J. Lace 5624* sheet at CAL and the confusion created by the second sheet. All three of the original collections mentioned by Lace (1914: 154) are present at Kew (K), and all are good quality sheets with no additional annotations by Parkinson, Nayar and Giri, or Larsen and Hu. Any of these specimens would be good candidates for election as a lectotype. However, Lace's original herbarium is housed at the Royal Botanic Gardens in Edinburgh (E), and both of his original collections are present and of equal quality. Although the selection of the *J. Lace 4627* specimen would be a less confusing selection, we reject it as a candidate primarily because of its uncertain presence in India as mentioned above. Thus, we elect to designate the *J. Lace 5624* specimen at E as the lectotype of *A. dawnaea*. It should be noted that this same sheet is also an isotype of *A. dawnensis*.

Acknowledgments. We gratefully wish to thank Kanchi Gandhi (GH) for his understanding and thoughtful comments regarding this complex taxonomic issue. Special thanks is extended to Yvette "Tivvy" Harvey of the Royal Botanical Gardens, Kew (K) for providing digital images of the material present at Kew. This project was aided greatly by the availability of herbarium images and data online. We deeply appreciate the ability to have public access to the information of the following institutions: The Royal Botanical Gardens, Edinburgh (<http://elmer.rbge.org.uk/bgbase/vherb/bgbasevherb.php>) and The Royal Botanical Gardens, Kew (<http://apps.kew.org/herbcat/gotoSearchPage.do>). We also gratefully acknowledge the uses of the JSTOR Plant Science web page at <http://plants.jstor.org>. Finally, we appreciate the availability of the Biodiversity Heritage Library, an outstanding project which is a "a consortium of natural history and botanical libraries that cooperate to digitize and make accessible the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global biodiversity commons" at <http://www.biodiversitylibrary.org>.

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Parkinson, C. E. 1934. On a botanical visit to Mulayit Peak, with a sketch of the vegetation of the Tenasserim hilltops. Indian Forester 60(4): 256–269.

A New *Senegalia* (Fabaceae, Mimosoideae) from Southern Peru

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Abstract. *Senegalia ebingeri* Seigler (Fabaceae, Mimosoideae) is described from Cusco and is known from Apurimac, Ayacucho, and Puno in southern Peru. The new species is illustrated and compared to its probable nearest relatives *S. tenuifolia* (L.) Britton & Rose, *S. riparia* (Kunth) Britton & Rose, and *S. tubulifera* (Benth.) Seigler & Ebinger.

Key words: Fabaceae, IUCN Red List, Mimosoideae, Peru, *Senegalia*.

Historically, the genus *Senegalia* Raf. has often been treated as part of *Acacia* Mill., s.l., but recent morphological and genetic studies have shown that this large genus is polyphyletic. Data derived from molecular studies have led to a better understanding of the relationships within the genus *Acacia* s.l., as well as the position of the genus within the Mimosoideae (Luckow et al., 2003; Maslin et al., 2003a; Miller & Bayer, 2003; Miller et al., 2003; Rico-Arce & Bachman, 2006; Seigler et al., 2006a; Bouchenak-Khelladi et al., 2010; Gómez-Acevedo et al., 2010; Murphy et al., 2010; Miller & Seigler, 2012; Kyalangalilwa et al., 2013). Based on these data, *Acacia* s.l. is now regarded as comprising at least five genera, *Acacia* s. str., *Acaciella* Britton & Rose (Britton & Rose, 1928), *Mariosousa* Seigler & Ebinger (Seigler et al., 2006b), *Senegalia* (Rafinesque, 1838), and *Vachellia* Wight & Arn. (1834) (see Miller & Seigler [2012] for an overview of the new generic classification).

Members of *Senegalia* are shrubs, trees, or lianas, unarmed or armed with prickles, but without stipular spines. The prickles usually are scattered but less commonly are grouped in twos or threes, usually at or near the nodes (Vassal, 1972). Leaves are bipinnate, and the petiole and primary rachis have sessile or stipitate glands of variable position. Flowers possess a ± tubular nectary below the usually stipitate ovary. Inflorescences are globose heads (capitula) or spikes, often grouped into complex terminal pseudoinflorescences or synflorescences. Pods are dehiscent, separating into two valves at maturity, or less commonly indehiscent or separating into indehiscent 1-seeded articles. The seeds are uniseriate.

The genus *Senegalia* consists of approximately 100 taxa in the Americas (unpublished data), as well as 69 in Africa, 43 in Asia, and two in Australia (Maslin et al., 2003a, 2003b). Eight species occur in two or more areas. During examination of numerous specimens of South American *Senegalia* species over the last 30 years, we have encountered 18 species that occur in Peru: *S. alemquerensis* (Huber) Seigler & Ebinger, *S. altiscandens* (Ducke) Seigler & Ebinger, *S. amazonica* (Benth.) Seigler & Ebinger, *S. hayesii* (Benth.) Britton & Rose, *S. klugii* (Standl. ex J. F. Macbr.) Seigler & Ebinger, *S. kuhlmannii* (Ducke) Seigler & Ebinger, *S. loretensis* (J. F. Macbr.) Seigler & Ebinger, *S. martii* (Benth.) Seigler & Ebinger, *S. multipinnata* (Ducke) Seigler & Ebinger, *S. polyphylla* (DC.) Britton & Rose, *S. rhytidocarpa* (L. Rico) Seigler & Ebinger, *S. riparia* (Kunth) Britton & Rose in Britton & Killip, *S. rurrenabaqueana* (Rusby) Seigler & Ebinger, *S. tenuifolia* (L.) Britton & Rose, *S. tomentella* Britton & Killip, *S. tubulifera* (Benth.) Seigler & Ebinger, *S. visco* (Lorentz ex Griseb.) Seigler & Ebinger, and *S. weberbaueri* (Harms) Seigler & Ebinger.

During the course of our work on Peruvian *Senegalia* species, an undescribed species was noted from herbarium materials of the regions of Apurimac, Ayacucho, Cusco, and Puno in southern Peru. This taxon is clearly distinctive and is herein proposed as a new species.

Senegalia ebingeri Seigler, sp. nov. TYPE: Peru. Cusco: Anta, Distr. Limatambo, bosque seco, 13°33′51″S, 072°34′27″W, 2032 m, (fl.), 20 Dec. 2002, *W. Galiano, L. Valenzuela, G. Calatayud & E. Suclli 4585* (holotype, ILL; isotypes, CUZ not seen, MO, USM not seen). Figure 1.

Diagnosis. *Senegalia ebingeri* Seigler differs from other *Senegalia* species by the presence of recurved prickles with a bulbous base, commonly paired at some nodes and, occasionally in threes, petiolar gland solitary, usually located near the middle of the petiole, pinnae in 3 to 11 pairs per leaf with 5–12 mm between pinna pairs, paraphyllidia present, leaflets 20 to 38 pairs per pinna, with a single midvein located submarginally, inflorescence a densely 15- to 40-flowered globose head, 13–20 mm across, and 1 to 3 capitula per leaf axil.

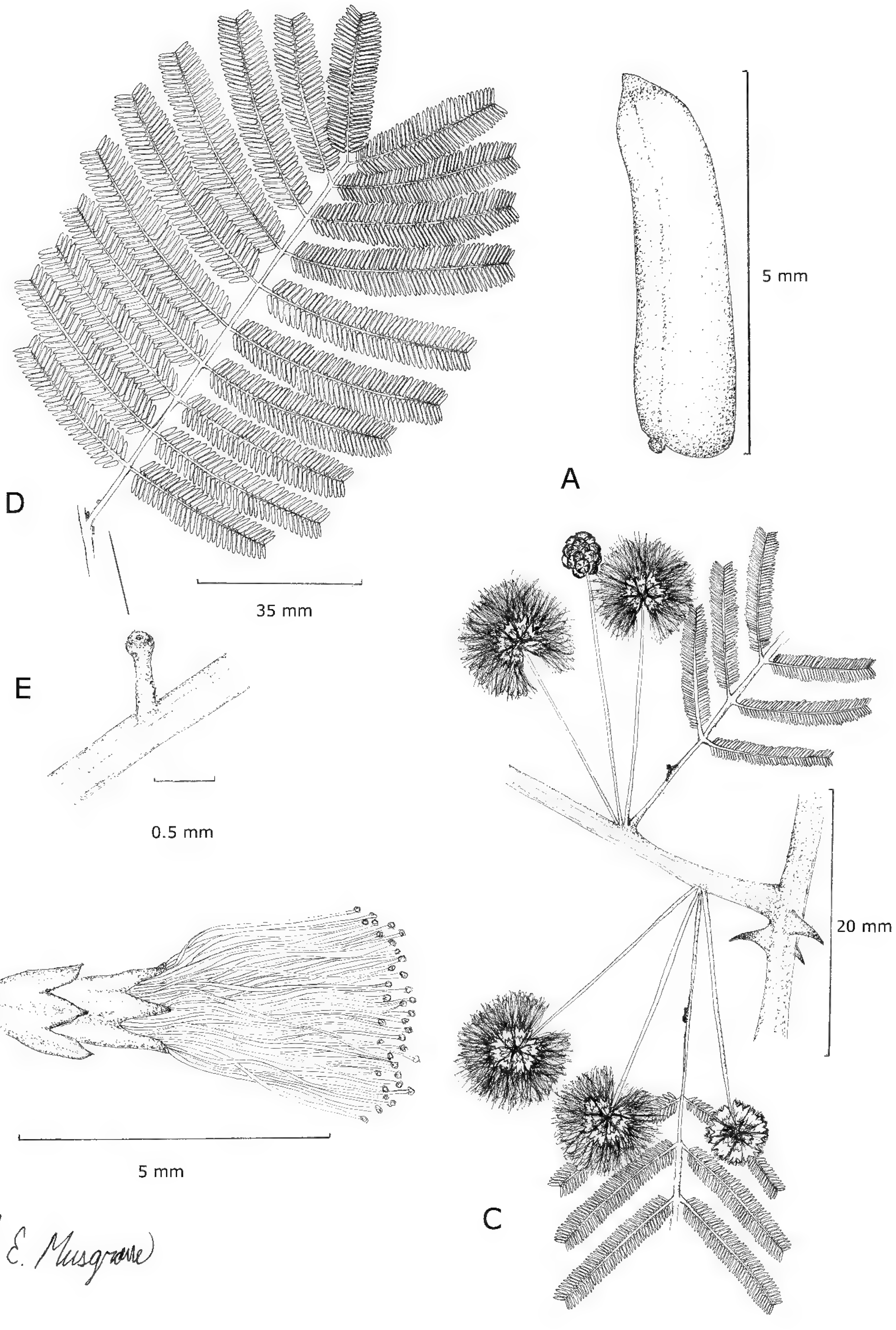


Figure 1. *Senegalia ebingeri* Seigler. —A. Leaflet, adaxial surface. —B. Flower. —C. Clustered inflorescences with associated leaves and prickles. —D. Complete leaf with petiolar gland. —E. Detail of petiolar gland. A, B drawn from *C. Vargas C. 9786* (MO); C drawn from the holotype *W. Galiano, L. Valenzuela, G. Calatayud & E. Suclli 4585* (ILL); D, E drawn from *W. Galiano & I. Huamantupa 4631* (MO).

Shrub or small tree to 10 m tall; bark not seen; twigs light gray to light brown, not flexuous, terete to slightly ridged, usually puberulent; short shoots absent; prickles light brown, 1–8 × 1–5 mm at a bulbous base, glabrous, scattered along the twig, petiole, and rachis, but commonly paired at some nodes, occasionally 3, the prickle apex usually darker, flattened, recurved, woody. Leaves alternate, 30–95 mm; stipules light brown, linear, 2–5 × 0.4–0.8 mm, symmetrical, flattened, straight, herbaceous, pubescent and ciliate, early deciduous; petiole 8–16 mm, adaxially grooved, puberulent; petiolar gland solitary, usually located near the middle of the petiole, mostly sessile but only attached near the middle, ovate to orbicular, 0.4–1 mm across, the margins turning upward, apex usually cup-shaped, glabrous, sometimes replaced by a narrow columnar gland to 0.7 mm long; rachis 20–85 mm, adaxially grooved, puberulent, with an oval gland 0.2–0.7 mm across between the upper 1 to 2 pinna pairs, the apex cup-shaped, glabrous; pinnae 3 to 11 pairs per leaf, 20–45 mm, 5–12 mm between pinna pairs; paraphyllidia 0.3–0.9 mm, sometimes absent; petiolule 0.8–2 mm; leaflets 20 to 38 pairs per pinna, oblong, 3.5–6.5 × 0.8–1.2 mm, opposite, 0.6–1.2 mm between leaflets, appressed-pubescent beneath and sometimes above, lateral veins not obvious, with only 1 vein evident from the base, base oblique and truncate on one side, margins lightly ciliate, apex acute, midvein submarginal. Inflorescence a densely 15- to 40-flowered globose head or capitulum, 13–20 mm across, with 1 to 3 capitula per leaf axil; peduncles 10–30 × 0.4–0.7 mm, lightly puberulent; receptacle enlarged, subglobose; involucre usually absent; floral bracts spatulate, 0.8–1.3 mm, puberulent, early deciduous. Flowers sessile, yellow; calyx 5-lobed, 1.8–2.6 mm, puberulent; corolla 5-lobed, 2.8–3.6 mm, puberulent, the lobes 1/4 the length of the corolla; stamens 50 to 70; filaments 6–8 mm; anther glands absent; ovary pubescent, on a stipe to 1.1 mm long. Fruits oblong, 60–110 × 17–27 mm, straight, flattened, slightly constricted between seeds, coriaceous, transversely striated, glabrous to lightly puberulent, eglandular, dehiscent along both sutures, apex acute, short beaked; stipe 5–11 mm; seeds not seen.

Distribution and ecology. *Senegalia ebingeri* was collected from forests and a disturbed site from 1000 to 2700 m in the regions of Apurimac, Ayacucho, Cusco, and Puno in southern Peru.

IUCN Red List category. *Senegalia ebingeri* is Data Deficient (DD) at this time (IUCN, 2001). However, *S. ebingeri* is apparently rare and found at higher elevations in southern Peru. We have seen fewer than 10 specimens, suggesting that this species may at least be Vulnerable, perhaps Endangered.

Phenology. *Senegalia ebingeri* was observed in flower from November to December and in fruit from February to June.

Etymology. *Senegalia ebingeri* is named for John Edwin Ebinger (1933–), an authority on mimosoid legumes, especially *Acacia* s.l., and also former curator of the Stover-Ebinger Herbarium at Eastern Illinois University, Charleston.

Discussion. Only six species of *Senegalia* are known from the range of *S. ebingeri* in southern Peru. These include *S. amazonica*, *S. loretensis*, *S. multipinnata*, *S. riparia*, *S. tenuifolia*, and *S. tubulifera*. Of these species, only *S. tenuifolia* is closely similar to *S. ebingeri*. *Senegalia tenuifolia* has solitary prickles that are not bulbous at the base. The globose inflorescences occur mostly in terminal pseudopaniculate clusters. In contrast, *S. ebingeri* has bulbous-based prickles, often paired or occasionally in threes near the nodes, and the globose inflorescences are in clusters of one to three in the leaf axils. Two other species, *S. riparia* and *S. tubulifera*, are somewhat less similar to *S. ebingeri* but generally have solitary, scattered prickles that are not bulbous at the base, two petiolar glands scattered along the petiole, the leaflet midvein is subcentral, and the globose inflorescences are mostly encountered in terminal paniculate clusters. In contrast, *S. ebingeri* commonly has mostly bulbous-based prickles that are paired or in threes near some of the nodes, a solitary petiolar gland, the leaflet midvein is submarginal, and the globose inflorescences or capitula are in clusters of one to three in the leaf axils.

Key to Species of *Senegalia* from the Range of *S. ebingeri* in Southern Peru

1a. Spicate inflorescence ..... *S. amazonica*
1b. Capitate or globose inflorescence.
  2a. Leaflets with midvein central or subcentral.
    3a. Inflorescences 6–10 mm in diam., distance between leaflets 0.3–0.7 mm, petiolule 0.5–1.5 mm ..... *S. multipinnata*
    3b. Inflorescences 14–20 mm in diam., distance between leaflets 0.8–1.9 mm, petiolule 1.5–3.5 mm.
      4a. Calyx 1.5–2.4 mm, corolla 2.7–4.0 mm ..... *S. riparia*
      4b. Calyx 0.7–1.7 mm, corolla 3.5–5.2 mm ..... *S. tubulifera*
  2b. Leaflets with midvein marginal or submarginal.
    5a. Prickles bulbous at base, paired or in threes at some nodes ..... *S. ebingeri*
    5b. Prickles flat at base, scattered, but seldom paired at nodes.

6a. Tree, leaflets oblong, appressed pubescent beneath, twigs glabrous to lightly puberulent ..... *S. loretensis*
6b. Climbing shrub or liana, leaflets linear, mostly glabrous, twigs densely pubescent ..... *S. tenuifolia*

Paratypes. PERU. **Apurimac:** Valley Apurimac, 2300 m, 8 June 1957 (fl.), [collector name not legible] *P1548* (NY); Abancay, 15 km [toward] Andahuaylas, 1900 m, 27 Mar. 1977 (fr.), *H. Ellenberg 7088* (US). **Ayacucho:** Wanta, Río Cachi, 2550 m, 1 Dec. 1964 (fl.), *C. Vargas C. 15848* (MO). **Cusco:** entre Cuzco y Abancay, Km. 96–97, 20 Nov. 1947 (fl.), *R. Ferreyra 2740* (MO, US); Anta, Distr. Mollepata, Cunyac, 963 m, 2 Feb. 2003 (fr.), *W. Galiano & I. Huamantupa 4631* (CUZ not seen, ILL, MO, USM not seen); Anta, Limatambo, Mollepata, Cunyac, Carhua, 2450–2710 m, 17 Nov. 2003 (fl.), *W. Galiano, E. Suclli, P. Nuñez & A. Rodríguez 5393* (CUZ not seen, MO); Anta, Sisal to Cunyac, 2020 m, 15 Nov. 1950 (fl.), *C. Vargas C. 9786* (MO). **Puno:** Santa Ana, 900 m, 25 June 1915 (fr.), *O. F. Cook & G. B. Gilbert 1485* (US).

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A New Species of *Senegalia* (Fabaceae, Mimosoideae) from Central America and Colombia

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ABSTRACT. *Senegalia croatii* Seigler & Ebinger is described from Panama and is distributed from Costa Rica, Honduras, Panama, and into Colombia. The new species is illustrated and compared to a morphologically similar species, *S. hayesii* (Benth.) Britton & Rose.

Key words: Fabaceae, IUCN Red List, Mimosoideae, *Senegalia*.

Historically, the genus *Senegalia* Raf. has often been treated as part of *Acacia* Mill., s.l., but recent morphological and genetic studies have shown that this large genus is polyphyletic. Data derived from molecular studies have led to a better understanding of the relationships within the genus *Acacia* s.l., as well as the position of the genus within the Mimosoideae (Luckow et al., 2003; Maslin et al., 2003a; Miller & Bayer, 2003; Miller et al., 2003; Rico-Arce & Bachman, 2006; Seigler et al., 2006a; Bouchenak-Khelladi et al., 2010; Gómez-Acevedo et al., 2010; Murphy et al., 2010; Miller & Seigler, 2012; Kyalangalilwa et al., 2013). Based on these data, *Acacia* s.l. is now regarded as comprising at least five genera, *Acacia* s. str., *Acaciella* Britton & Rose (1928), *Mariosousa* Seigler & Ebinger (Seigler et al., 2006b), *Senegalia* (Rafinesque, 1838), and *Vachellia* Wight & Arn. (1834) (see Miller & Seigler [2012] for an overview of the new generic classification).

Members of *Senegalia* are shrubs, trees, or lianas, unarmed or armed with prickles, but without stipular spines. The prickles usually are scattered but less commonly are grouped in twos or threes, usually at or near the nodes (Vassal, 1972). Leaves are bipinnate, and the petiole and primary rachis have sessile or stipitate glands of variable position. Flowers possess a more or less tubular nectary below the usually stipitate ovary. Inflorescences are globose heads (capitula) or spikes, often grouped into complex terminal pseudoinflorescences or synflorescences. Pods are dehiscent, separating into two valves at maturity, or less commonly indehiscent or separating into indehiscent 1-seeded articles. The seeds are uniseriate.

The genus *Senegalia* consists of approximately 100 taxa in the Americas (unpublished data), as well as 69 in Africa, 43 in Asia, and two in Australia (Maslin et al., 2003a, 2003b). Eight species occur in two or more areas. During examination of numerous specimens of Central and South American *Senegalia* species over the last 30 years, we have encountered 11 species that occur from Honduras to Panama and 19 species that are found in Colombia, many of which are also found in Central America. Among these, we encountered a previously undescribed species from herbarium materials of Costa Rica, Honduras, Panama, and Colombia. This taxon is clearly distinctive and is herein proposed as a new species.

Senegalia croatii Seigler & Ebinger, sp. nov. TYPE: Panama. Panamá: Barro Colorado Island, shortcut from Barbour to Lutz Trail, 6 Feb. 1971 (fr.), *T. B. Croat 13248* (holotype, MO-2033512; isotypes, F, NY). Figure 1.

Diagnosis. *Senegalia croatii* Seigler & Ebinger differs from other *Senegalia* species of Central America and Colombia by leaf size (7–43 cm), a single ovate to orbicular petiolar nectary (0.7–3.3 mm) with irregularly globose apex borne basally on the petiole, distance between pinna pairs (10–30 mm), distance between leaflet pairs (2.1–4.1 mm), and a capitate inflorescence 9–12 mm in diameter.

Liana, to 20 m tall; bark brownish gray to brownish red, smooth to shallowly ridged; twigs light brown to light gray-brown, not flexuous, terete, ridged on older branches, usually lightly puberulent; short shoots absent; prickles light brown, becoming dark brown above, flattened, recurved, woody, 1–5 × 1–5 mm at the base, glabrous to puberulent at the base, commonly in lines on the branch ridges, also widely scattered along the twig, petiole, and rachis. Leaves alternate, 7–43 cm; stipules light to dark brown, narrowly lanceolate, symmetrical, flattened, straight,

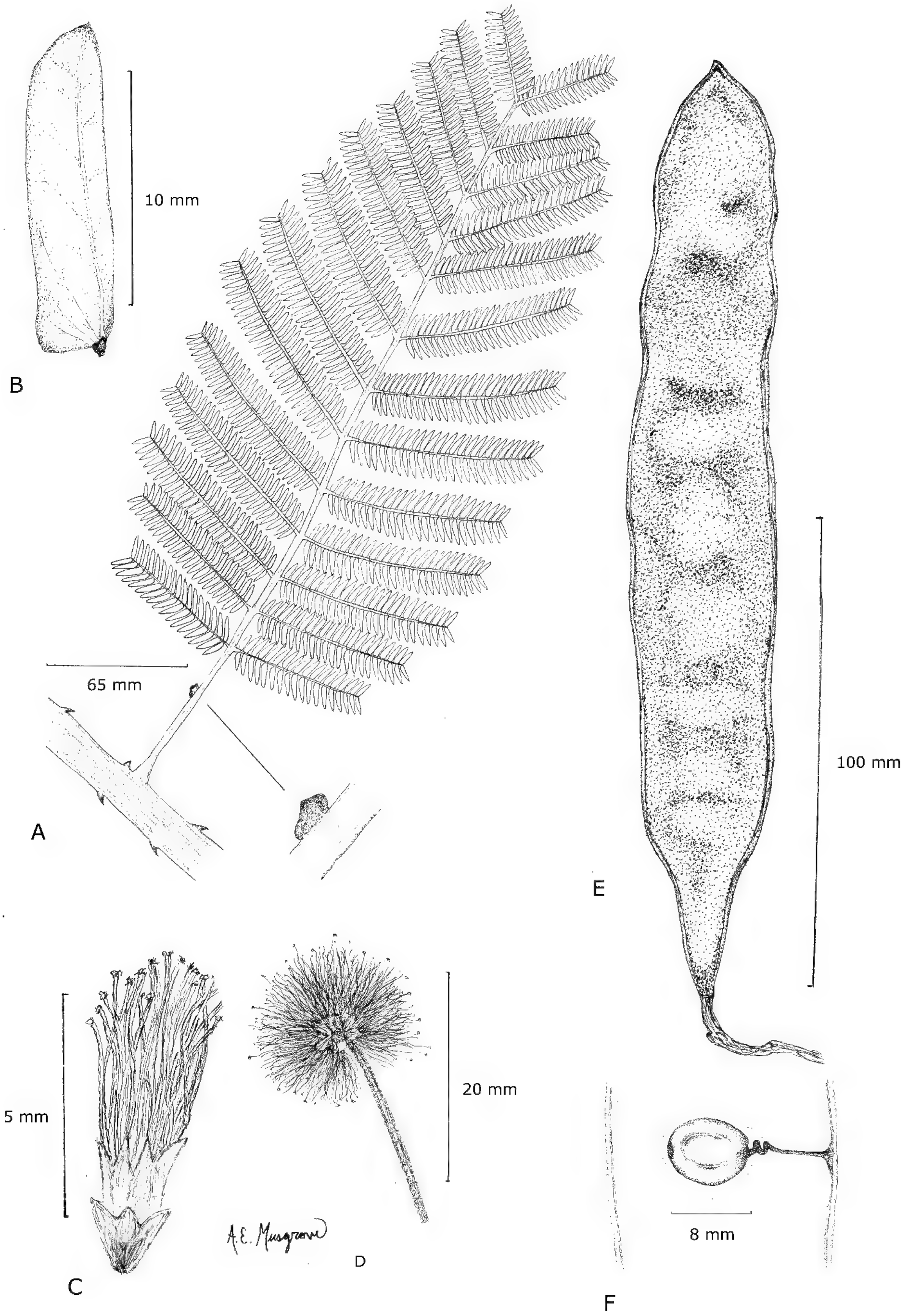


Figure 1. Vegetative structures of *Senegalia croatii* Seigler & Ebinger. —A. Leaf with detail of petiolar gland (drawn from *L. J. Baltimer 1634*, MO). —B. Leaflet, adaxial surface (drawn from *M. Nee 7800*, MO). Detail of reproductive structures of *S. croatii* Seigler & Ebinger. —C. Inflorescence. —D. Flower. —E. Fruit. —F. Seed with funicle. C–D drawn from *M. Nee 7800* (MO); E–F, from *N. C. Garwood & M. Marmolejo 2064A* (F).

herbaceous, 4–10 × 1–2 mm near the base, puberulent, early deciduous; petiole terete to shallowly adaxially grooved, 3–12 cm, glabrous to lightly puberulent; petiolar glands solitary, located near the base of the petiole, sessile, oval to oblong, 0.7–3.3 mm, glabrous, the apex globose; rachis adaxially grooved, 6–34 cm, puberulent, an oval gland 0.4–1.2 mm across, located between the upper 1 to 4 pinna pairs, glabrous, apex slightly globose; pinnae 11 to 24 pairs/leaf, 5.5–13 cm, 10–30 mm between pinna pairs; paraphyllidia 0.7–1.3 mm, sometimes absent; petiolules 1.5–6.5 mm; leaflets 20 to 40 pairs/pinna, opposite, 2.1–4.1 mm between leaflets, oblong, 7–17 × 2.1–4 mm, glabrous to densely pubescent beneath and sometimes above, 3 to 4 veins from the base, lateral veins obvious, the base oblique, truncate on one side, margins lightly ciliate, apex acute, the midvein submarginal. Inflorescence a densely 20- to 35-flowered globose head, each head 9–12 mm across, in terminal and axillary pseudopaniculate clusters, the main axis to 50 cm; peduncles 4–20 × 0.3–0.6 mm, puberulent; receptacle elongated, slightly enlarged; involucre absent; floral bracts spatulate, 0.5–0.8 mm, puberulent, early deciduous. Flowers sessile, white; calyx 5-lobed, 0.9–1.7 mm, puberulent; corolla 5-lobed, 1.6–2.6 mm, glabrous to puberulent, the lobes 1/4 the length of the corolla; stamens 50 to 70; filaments distinct, 4–6 mm; anther glands present; ovary pubescent, stipe to 2.1 mm. Fruits oblong, 150–270 × 26–36 mm, straight, flattened, not constricted between the seeds, chartaceous, transversely striated, puberulent, eglandular, dehiscent along both sutures, stipe 11–18 mm, apex acute, short-beaked; seeds uniseriate, 7–10 × 5.5–7.4 mm, oblong to orbicular, strongly flattened, smooth, no pulp, dark reddish brown; pleurogram U-shaped, 2–4 mm across.

Distribution and ecology. *Senegalia croatii* has been collected from humid evergreen tropical forests, disturbed second growth forests, and thickets from near sea level to 600 m. Distribution of the new species is documented from Costa Rica, Honduras, Panama, and Colombia.

IUCN Red List category. As we have seen more than 15 collections of this species from Honduras to Colombia, it does not seem probable that this species presently is seriously threatened. However, humid tropical forest is disappearing, and additional data concerning the future of *Senegalia croatii* need to be obtained (IUCN, 2001). Therefore, we consider this species Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Senegalia croatii* has been observed as flowering between October and November and fruiting between April and September.

Discussion. *Senegalia croatii* has been frequently misidentified and confused with *S. hayesii* [≡ *Acacia hayesii* Benth.]. Material considered to be *A. hayesii* by Croat (1978), at least in part (*Croat 6202*, MO), belongs to this newly described species. The two taxa are similar, both being large climbing shrubs (often appearing as lianas) or trees that grow in lowland humid tropical forests through Central America and northern South America, with *S. hayesii* being more widespread in distribution, occurring from Mexico to Panama and into South America in Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela. However, the two taxa are easily separated, *S. hayesii* having two to four glands scattered along the petiole, whereas the gland is solitary and restricted to the base of the petiole in *S. croatii*. The inflorescence of *S. hayesii* is a cylindrical spike, 18–37 × 16–22 mm; the inflorescence of *S. croatii* is globose, 8–12 mm in diameter. Given that the descriptions for *S. hayesii* of Croat (1978) and Woodson and Schery (1950) are in part based on this new species, those descriptions should be carefully reexamined.

Although *Senegalia croatii* is similar to and co-occurs with *S. hayesii* in most of its range, the affinities of *S. croatii* probably lie with species similar to *S. amazonica* (Benth.) Seigler & Ebinger. As is true for these species, the petiolar gland of *S. croatii* is bulbous to globose and located near the base of the petiole. *Senegalia croatii* also shares many features with a primarily Mexican species, *S. membranacea* Britton & Rose.

Paratypes. COLOMBIA. **Bolívar:** Santuario Nac. de los Colorados, 230–250 m, 13 Jan. 1988, *A. Gentry, H. Cuadros & P. Keating 60661A* (MO). **Sucre:** Coloso, finca El Sereno, de Don Eugenio Márquez, 300 m, 26 Oct. 1989 (fl.), *H. Cuadros & A. Gentry 4644* (JBGP not seen, MO, NY). COSTA RICA. **Alajuela:** Calera de San Ramón, 14 Dec. 1928, *A. M. Brenes 6498a* (NY); La Calera de San Ramón, 22–23 Jan. 1936, *A. M. Brenes 21–418* (F). **Puntarenas:** Curú, Punta Blanca trail toward P. Georgia, 100 m, 13 Sep. 1995, *A. C. Sanders & M. Baker 17869* (BRIT, NY). HONDURAS. **Atlántida:** Lancetilla Valley, near Tela, 20–600 m, 6 Dec. 1927–20 Mar. 1928 (fr.), *P. C. Standley 53865* (F). PANAMA. **Bocas del Toro:** region of Almirante, Jan.–Mar. 1928, *G. P. Cooper 110* (F, NY). **Colón:** 2 km S of Madden Dam, 50 m, 4 Nov. 1973 (fl.), *M. Nee 7800* (MO, TEX, WIS). **Darien:** 23 km SE of Jaqué, 24 Jan. 1981, *N. C. Garwood 1131* (MO); **Panamá:** Barro Colorado Island, s.d. (fl.), *Aviles* [no initials] *10b* (MO); Summit Garden, 3 Dec. 1964, *L. J. Baltimer 1634* (MO); Barro Colorado Island, clearing at laboratory, 21 May 1968 (fr., wood), *T. B. Croat 5754* (F, MO [2], NY); Barro Colorado Island, Wheeler Trail, 19 Sep. 1968, *T. B. Croat 6202* (MO); Barro Colorado Island, Shannon Trail, 18 Feb. 1969, *T. B. Croat*

8028 (MO); forest near dam site S of Canita, 1 May 1971, *T. B. Croat 14516* (MO); trail betw. Río Maje & Quebrada Brava, 60 m, 4 May 1976, *T. B. Croat 34645* (MO), Barro Colorado Island, 3 Apr. 1987 (fr.), *N. C. Garwood & M. Marmolejo 2064A* (F); betw. Chepo & El Llano, 9 Oct. 1972 (fl.), *A. Gentry 6457* (LL, MO), Barro Colorado Island, July 1931, *D. E. Starry 97* (MO).

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Lectotypification in American *Acacia* species (Fabaceae, Mimosoideae), with Clarifications for Types at the Muséum national d'Histoire naturelle

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Abstract. Lectotypifications are made for three species in *Mimosa* L. (Fabaceae, Mimosoideae): *M. angustisiliqua* Lam. [= *Desmanthus virgatus* (L.) Willd.], *M. arabica* Lam. [= *Vachellia nilotica* (L.) P. J. H. Hurter & Mabb.], and *M. strombulifera* Lam. [≡ *Prosopis strombulifera* (Lam.) Benth.]. Clarification for type material at the Muséum national d'Histoire naturelle (P) is included for other plants either native to or adventitive in the New World and originally described as *Acacia* Mill.

Keywords: *Acaciella*, *Acacia*, Fabaceae, *Mariosousa*, Mimosoideae, *Senegalia*, *Vachellia*.

The herbarium of the Muséum national d'Histoire naturelle (P) is a rich source of type material for species either described within *Acacia* Mill. (Fabaceae, Mimosoideae) or later transferred to this genus. A search was made of the Humboldt and Bonpland (P-Bonpl.), Lamarck (P-LA), Jussieu (P-JU), and Desvaux (P) herbaria, as well as the general collections of the herbarium of P. Previously unrecognized type materials were discovered.

As conceived by Willdenow (1806, 1809), Kunth (1823, 1825), de Candolle (1825), and other early taxonomists, the genus *Acacia* was quite diverse and many of the species now belong to other genera of mimosoid legumes, among them *Albizia* Durazz., *Calliandra* Benth. (Barneby, 1998), *Lysiloma* Benth. (Barneby & Grimes, 1996, 1997), *Mimosa* L. (Barneby, 1991), and *Pithecellobium* Mart. Based largely on the concepts of Bentham (1842, 1875, 1876), the genus *Acacia* was limited to species with numerous stamens (20 to 200) and stamen filaments free to the base. This concept remained largely the same until the 20th century when Vassal (1972) and Pedley (1978) refined the subgeneric treatment of this rather large genus. In 1986, Pedley suggested that the genus should be divided into three genera, *Acacia*, *Senegalia* Raf., and *Racosperma* Mart. Nonetheless, most botanists continued to accept *Acacia* s.l. until Maslin et al. (2003) suggested that the time had come to depart from this viewpoint.

In 2005, the International Botanical Congress in Vienna approved a proposal to change the type of the genus *Acacia* from an African species, *A. scorpioides* (L.) W. Wight (= *A. nilotica* (L.) Willd. ex Delile, = *Vachellia nilotica* (L.) P. J. H. Hurter & Mabb.; *Acacia* subg. *Acacia*) by recognizing an Australian species, *A. penninervis* Sieber ex DC. (*Acacia* subg. *Phyllodineae* Benth.) as a conserved type (Orchard & Maslin, 2003; McNeill et al., 2005). This typification was upheld recently at the XVIIIth International Botanical Congress in Melbourne in July 2011 (McNeill & Turland, 2011), but remains controversial (Rijckevorsel, 2006; Moore, 2007; Smith & Figueirido, 2011). If one chooses to recognize the *Acacia* s.l. as a single genus, this decision requires no major change in nomenclature. However, an accumulation of both morphological and molecular data for *Acacia* s.l. (Acacieae), Ingeae, and Mimoseae strongly supports segregation of *Acacia* s.l. into at least five entities: the genera *Vachellia* Wight & Arn. (Seigler & Ebinger, 2005; Kodela & Wilson, 2006), *Senegalia* (Seigler et al., 2006a; Seigler & Ebinger, 2009), *Acaciella* Britton & Rose (Britton & Rose, 1928; Rico-Arce & Bachman, 2006), *Mariosousa* Seigler & Ebinger (Seigler et al., 2006b), and *Acacia* s. str. (primarily Australian species of the former *Acacia* subg. *Phyllodineae*). Many types for American species of *Acacia* are found at P, many of these now recognized as

members of other genera. Others were originally described in other genera but were later considered to be members of *Acacia* s.l.

I. Acacia Mill., Gard. Dict. Abr., ed. 4, 1: 25. 1754. TYPE: *Acacia penninervis* Sieber ex DC., typ. cons.

1. Acacia angustifolia (Lam.) Desf., Tabl. École Bot. (ed. 2.) 208. 1815. Basionym: *Mimosa angustifolia* Lam., Encycl. 1: 12. 1783, non *Mimosa angustifolia* Jacq., Pl. Rar. Hort. Schoenbr. 3:74, pl. 39. 1798, nom. illeg. *Senegalia angustifolia* (Lam.) Britton & Rose, N. Amer. Fl. 23: 113. 1928. TYPE: Hispaniola. "tendre à caillou franc," Nicols. Hist. nat. de Saint-Domingue [specimen possibly from Nicholson with "le tendre à caillou d'amérique" written on sheet label], s.d., *s. coll. s.n.* (holotype, P-LA [barcode] 000297113). Figure 1.

Examination of possible type material for *Acacia angustifolia* from the island of Hispaniola revealed two specimens in Lamarck's herbarium that appear relevant to this species name. Lamarck (1783: 12) cited "tendre à caillou franc" of Nicolson (1776: 311) in his protologue for *Mimosa angustifolia* Lam., which borrowed heavily from earlier accounts. The name "tendre à caillou" was used in general in the Antilles for diverse nonspiny species of Acacia; "tendre à caillou franc" was the true tendre à caillou species. Nicolson's description contained neither a Latin binomial nor a direct reference to any potential type material, but he observed that the flowers of the plant were "en grappe" or in clusters, that the pods were 4–6 in. (100–150 mm) long, and that the seeds resembled lentils. Lamarck (1783) noted that the tree grew in the Jardin du Roi, but that he had not seen the flowers. One of the specimens at P-LA (P [barcode] 000297113; Fig. 1A) has "le tendre à caillou d'amerique" written on a small label on the sheet in Lamarck's handwriting. This supports the specimen's authentic use by Lamarck as the type for his description of *M. angustifolia*. The fruit on this specimen is 100–120 mm in length, yellowish, and apparently chartaceous.

The second specimen at P-LA (P barcode [00297114] not illustrated herein), located in the same folder as the holotype, has "*Mimosa angustifolia*" written in a different hand on a small label bearing the numbers 116 316. This specimen has inflorescences in clusters, reminiscent of Nicolson's "en grappe" (1776: 311), probably resulting in a paniculate inflorescence structure on maturity. It is unlikely that Lamarck used this specimen when he described *M. angustifolia* because he noted that he had not seen the flowers (1783: 12, "Je n'ai pas vu les fleurs."). The presence of flowers on this sheet excludes it as originally considered by Lamarck, and it is not the type nor is it syntypic.

Although the basionym *Mimosa angustifolia* and the successive names *Acacia angustifolia* and *Senegalia angustifolia* are all validly published legitimate names, we are unable to unambiguously assign the species name to a currently recognized taxon.

2. Desmanthus virgatus (L.) Willd., Sp. Pl. 4: 1047. 1806. Basionym: *Mimosa virgata* L., Sp. Pl. 1: 519. 1753. TYPE: "Habitat in India," Herb. Linn. 1228.13 (lectotype, designated by Fawcett & Rendle [1920: 132], LINN).

Mimosa angustisiliqua Lam., Encycl. 1: 10. 1783, nom. illeg. *Acacia angustisiliqua* (Lam.) Desf., Tabl. École Bot. (ed. 2.) 208. 1815. TYPE: America. "[C]ette plante croît en Amérique, et est cultivée au Jardin du Roi," s.d., *s. coll. s.n.* (lectotype, designated here, P-LA, P [barcode] 000297077). Figure 2.

No collection was mentioned by Lamarck in the 1783 account for *Mimosa angustisiliqua*, although he cited a figure from Plukenet (1696: alm. 253, tab. 307, fig. 3). In addition, a single specimen at P-LA was found that also was used by Lamarck to describe *M. angustisiliqua*. There is a small label at the lower left of the sheet, written in the hand of Lamarck, noting "*Mimosa angustisiliqua* enc." The abbreviation "enc." was used by Lamarck to indicate that the species was included in his Encyclopédie. This small label is affixed to a larger label where "11 *D. strictus* Bertol." is handwritten in an unidentified hand. "*Desmanthus*" is written in pencil on a third label at the specimen's lower right that identifies the sheet as belonging to the "Herbier de Lamarck, Herb. Mus. Paris." This species was referred to *Desmanthus*, but in synonymy to *D. virgatus* (L.) Willd. (Desfontaines, 1829; Bentham, 1875). The name *M. angustisiliqua* is illegitimate, as Lamarck included Linnaeus's earlier name *M. virgata* L. Further, both the Plukenet figure and the above specimen are syntypic. We designate the specimen (P) as a lectotype for the illegitimate name *M. angustisiliqua*.

3. Prosopis strombulifera (Lam.) Benth., J. Bot. (Hooker) 4(31): 352. 1841, as "*strombulifera*." Basionym: *Mimosa strombulifera* Lam., Encycl. 1: 15. 1783, as "*strumbulifera*." *Mimosa retortunium* Hort. Par. ex Lam., Encycl. 1: 15. 1783, nom. illeg. superfl. *Acacia strombulifera* (Lam.) Willd., Sp. Pl. 4: 1055, as "*strombulifera*." 1806. *Strombocarpa strombulifera*

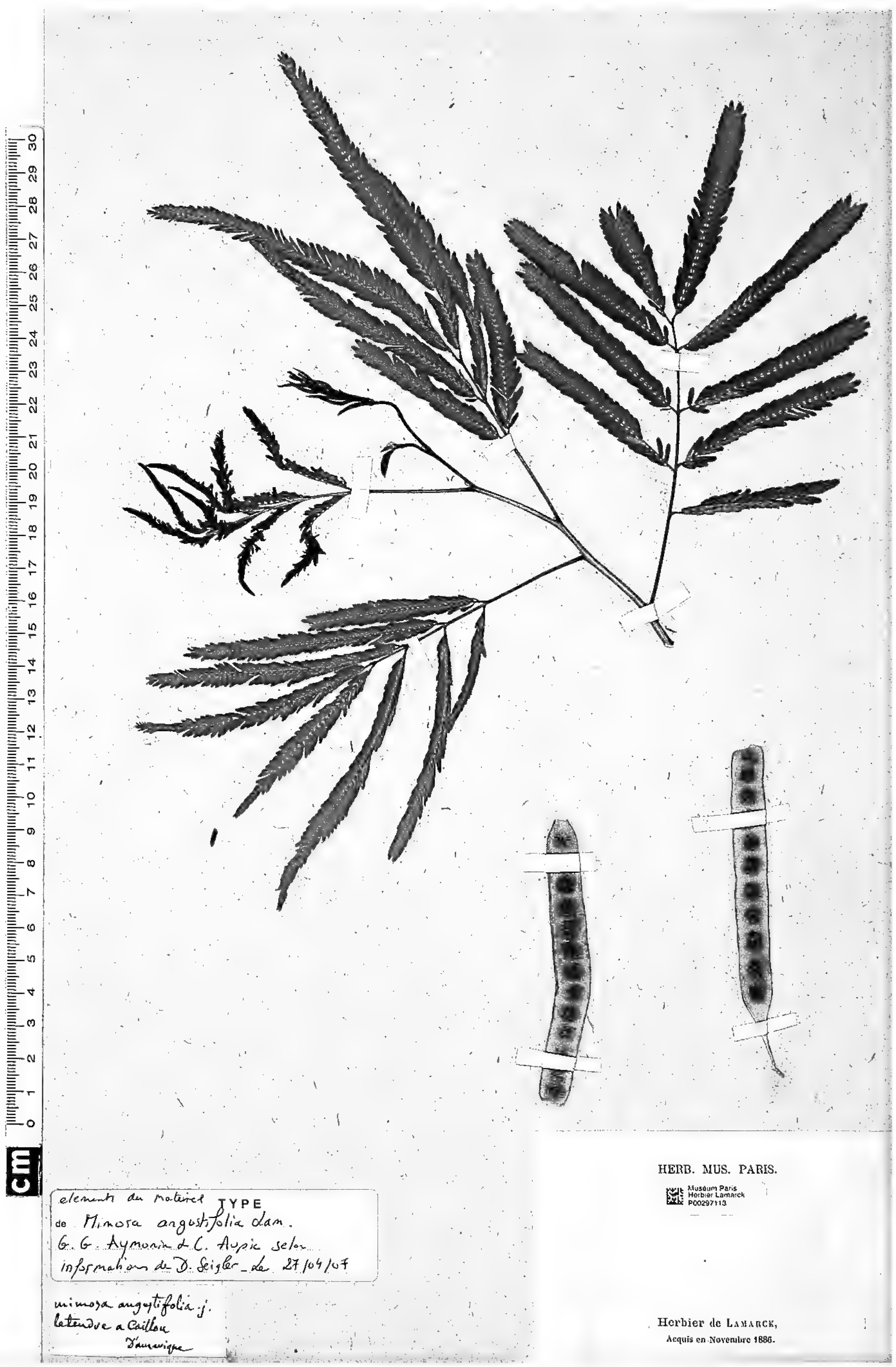


Figure 1. Holotype of *Mimosa angustifolia* Lam., *s. coll. s.n.* (P-LA).

(Lam.) A. Gray, U. S. Expl. Exped., Phan., 1: 475. 1854, as "*strombulifera*." TYPE: Peru. "Cet arbriseau est originaire du Pérou et cultivé au Jardin du Roi," s.d., *s. coll. s.n.* (lectotype, designated here, P-JU-14434, fruit collection at upper right). Figure 3.

One specimen at P-LA (P [barcode] 00297111) represents this taxon and has a single twig bearing several leaves and two older labels. At the lower left of the sheet is what appears to be an older or original label with the handwriting "*Acacia strumbuliferum* W." (presumably by Willdenow) to which has been

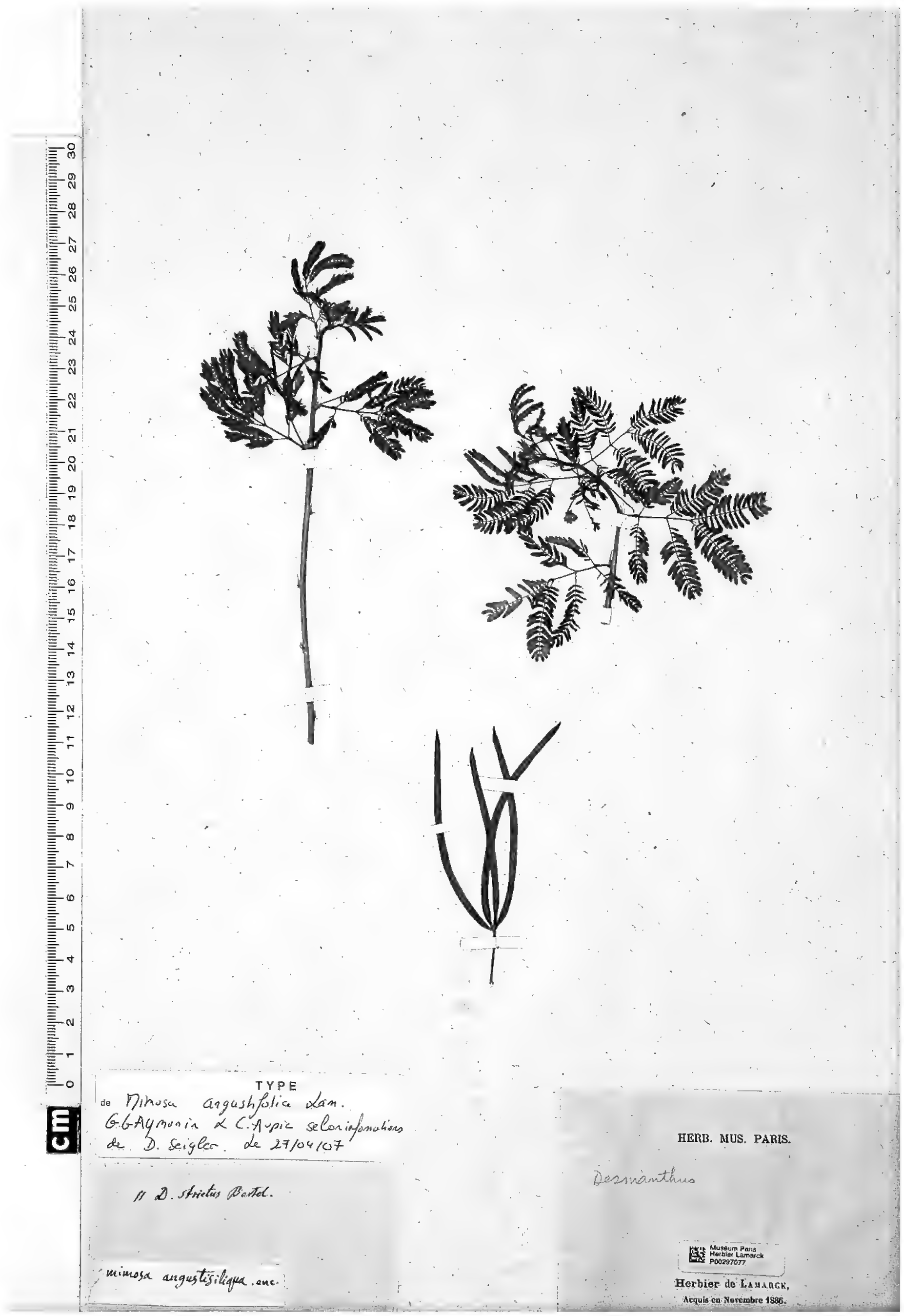


Figure 2. Lectotype of *Mimosa angustisiliqua* Lam., *s. coll. s.n.* (P-LA).

affixed a smaller label with the hand "*Mimosa retortunium* j." (presumably by Lamarck). To the right is the usual Paris label that identifies the collection as part of the Herbier de Lamarck. Another sheet was seen in the Jussieu Herbarium (P-JU) that bears a larger twig and is annotated as "*Mimosa strumbulifera* Lamarck; *Acacia strumbulifera* Willd., no. 18; DC 2: 255. n. 659; *Acacia* peruv. spin., fruits medica tornata longior. retornato. hispano [——], Jos. [?], h. r. p. cat. aff. [?], in h. r. paris" in the lower left hand corner, and a cluster of three fruits in the upper right corner. A label below the three fruits notes

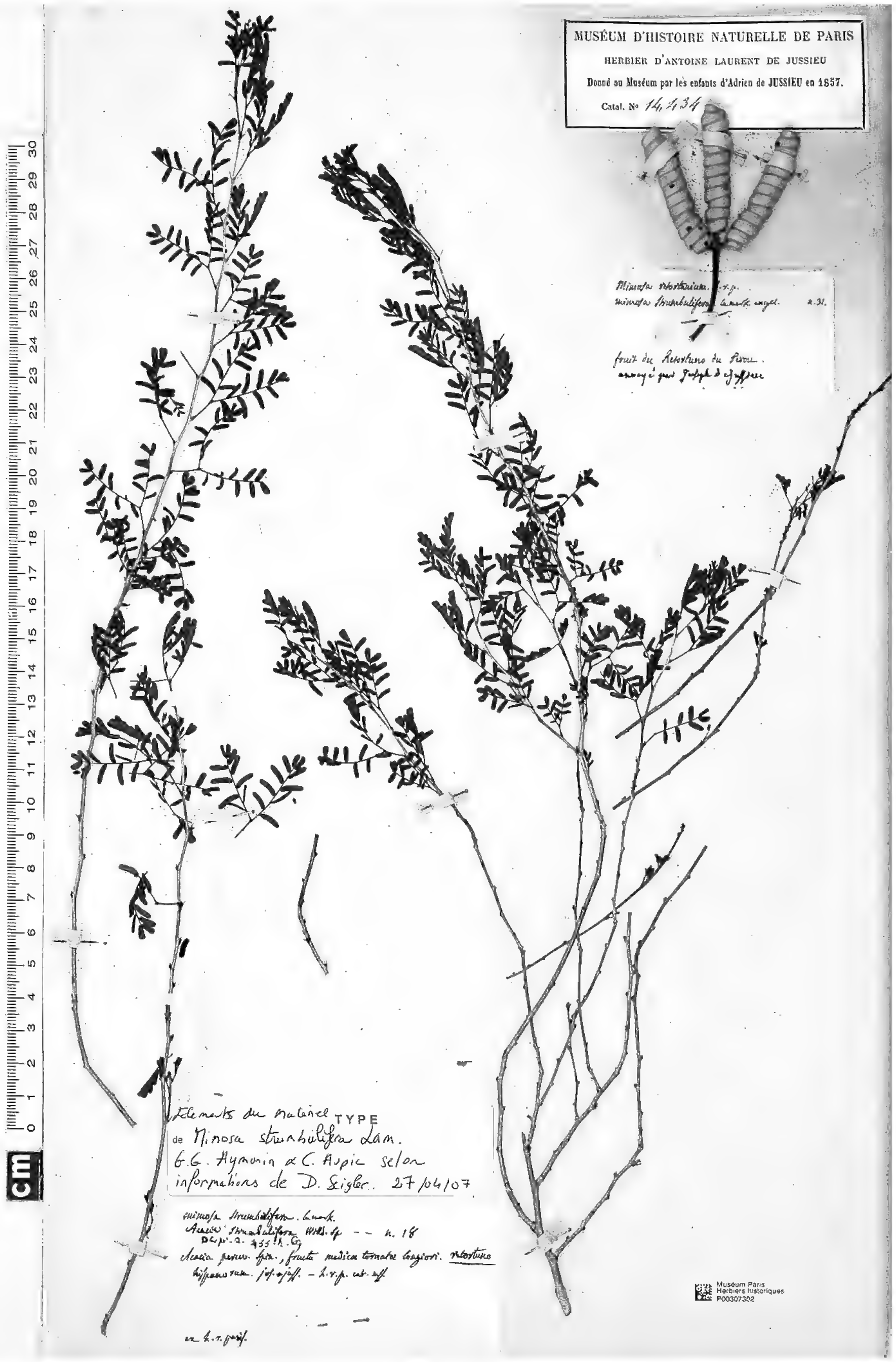


Figure 3. Lectotype of *Mimosa strombulifera* Lam., *s. coll. s.n.* (P-LA).

"*Mimosa retortunium* h. r. p., *Mimosa strumbulifera* Lamarck, encyl. n. 31, fruit de Retortuno du Perou, envoyée par Joseph [?]" Each of these (the two twigs and the fruit) seem to represent the same species and perhaps the same collection.

These sheets appear to represent syntypes of the same collection. Based on the protologue, Lamarck clearly saw fruits of this species "les fruits sont des gousses jaunâtres . . . ." Although Lamarck's hand-writing on the label on the sheet in the Lamarck

Herbarium indicates that he saw that material, his description was based on living material in the Hortus Reg. Parisiensis (v.v.) at the time the Encyclopédie was written. The "j" following the binomial on the lower label of the specimen in his herbarium suggests that Lamarck attributed the name or, perhaps, the specimen to Jussieu's herbarium. Jussieu was at the Hortus Reg. Parisiensis during this time period, but it is not known when any of the three specimens was collected.

Because Lamarck includes the fruit in his description and fruit characters are distinctive and useful for identification of *Prosopis strombulifera*, we elect the collection on the upper right-hand corner of the sheet of the specimen from the Jussieu Herbarium (14434) as the lectotype.

This species, now recognized as *Prosopis strombulifera* (Lam.) Benth., is native to the west coast of South America, but is invasive in other areas, such as California in the United States (Burkart, 1976; Zuloaga, 1999).

4. Senegalia rugata (Lam.) Britton & Rose, N. Amer. Fl. 23(2): 120. 1928. Basionym: *Mimosa rugata* Lam., Encycl. 1: 20. 1783. *Acacia rugata* (Lam.) Buch.-Ham. ex Voigt, Hort. Suburb. Calcutt. 263. 1845. TYPE: India. "Cet arbre croît dans l'Inde, & m'a été communiqué par M. Sonnerat," s.d., *s. coll. s.n.* (holotype, P-LA [barcode] 00297138). Figure 4.

Acacia rugata Buch.-Ham. in Wall. ex Benth., London J. Bot. 1: 514. 1842. nom. illeg. superfl. TYPE: East Indies, *Hamilton s.n.* (type, K-W-5251).

A single specimen of *Mimosa rugata*, which appears to be the material used by Lamarck to describe this species, was located at P-LA (Fig. 4). He notes in the Encyclopédie (1783: 20) that the plant grows in India and was sent to him by P. Sonnerat. On a small label in Lamarck's hand at the lower left of the sheet is "le grand acacia epineux, *Mimosa rugata* enc." Accompanying this to the right is the label identifying the collection as the "Herbier de Lamarck." On a larger label at the lower left is noted "*A.? concinna* DC., *M.* —— W.," and "*M. saponaria* Roxb.," with the number 159 in the corner of the label. This may refer to *Acacia concinna* DC. (1825) and *M. concinna* Willd. (1806), both names synonymized to *Senegalia rugata* (Lam.) Britton & Rose by the latter authors who include a question mark, "Senegalia (?) rugata (Lam.) Britton & Rose," perhaps predicated by their statement "[n]aturalized in Jamaica; native of southern Asia" (Britton & Rose, 1928: 120). This was an opinion followed by others (Fawcett & Rendle, 1920; Adams, 1972; Nielsen, 1980, 1985; Rico-Arce, 2007).

5. Senegalia skleroxyla (Tussac) Seigler & Ebinger, Phytologia 91(1): 28. 2009. Basionym: *Acacia skleroxyla* Tussac, Fl. Antill. 1: 146–148, tab. XXI [21]. 1808 [vol. 1 publ. 1808–1813]. TYPE: Antilles. Santo Domingo (holotype, tab. XXI [21] in Tussac [1808]). Figure 5.

Tussac's name is the oldest available validly published name for this taxon. His plate is cited in Flore des Antilles (1808) and represents the holotype of this species. No other collections are mentioned in his protologue nor was any material located at Kew.

However, in an observation, Tussac (1808) states that Lamarck had previously (1783) discussed "tendre à caillou bâtard" in his treatment of "tendre à caillou franc." There is a specimen at P-LA (P [barcode] 00297058) (Fig. 6) found within the same folder that contains the holotype of *Acacia angustifolia* (Lam.) Desf. [≡ *Mimosa angustifolia* Lam.] (P-LA [P (barcode) 000297113]). The former sheet has "... tendre à caillou bâtard" ["atypical tendre à caillou"] written on a small label at the lower left of the sheet, in Lamarck's handwriting, and it has five fruits mounted on the sheet, with three seeds in a single packet. Lamarck's discussion of "tendre à caillou bâtard" was in turn based on Nicolson (1776), whose account also lacked a Latin binomial and did not mention any specific collection. The fruits on the specimen seen by Lamarck clearly differ and are of a species other than those of the other two specimens in the *A. angustifolia* folder. The fruits on the third sheet are flat, ca. 130–180 mm in length, dark in color, somewhat constricted between the seeds, and with clearly visible reticulate venation. The seeds are oblong to quadrangular in outline (Fig. 6). These fruits and seeds correspond to those described for Tussac's *A. skleroxyla*. The name *A. scleroxyla* (1808) is written in yet another hand on a second label at the lower left of this sheet, possibly the hand of de Candolle. Nonetheless, this specimen does not represent type material. Further, a specimen from San Domingo, an Ehrenberg collection, and others cited by Bentham (1875: 522) have no taxonomic standing as they are not cited in the original protologue of Tussac.

Barneby and Zanoni (1989) observed that the correct orthography of the specific epithet is *skleroxyla* as used by Tussac (1808) and is not correctable to *scleroxyla*, as has been done (Bentham, 1875; Liogier, 1985; Rico-Arce, 2007).



Figure 4. Holotype of *Mimosa rugata* Lam., *s. coll. s.n.* (P-LA).

6. Vachellia nilotica (L.) P. J. H. Hurter & Mabb., Pl. Book, ed. 3. Basionym: *Mimosa nilotica* L., Sp. Pl. 521. 1753. *Acacia nilotica* (L.) Willd. ex Delile, Descr. Égypte, Hist. Nat. 2: 79. 1813. TYPE: South Africa. "Habitat in Aegypto, unde semina per D. Hasselquist," *Hasselquist s.n.*, Herb. Linn 1228.28 (lectotype, designated by Fawcett & Rendle [1920: 140]; Ross [1979], LINN; isolectotype, Herb. Linn. 214.7, S image).

Mimosa arabica Lam., Encycl. 1: 19. 1783. *Acacia arabica* (Lam.) Willd., Sp. Pl. 4: 1085. 1806. TYPE: "Arabie



Figure 5. Holotype of *Acacia skleroxyla* Tussac (tab. XXI [21] in Tussac, 1808).

& en Africa," s.d., *P. Sonnerat s.n.* (lectotype, designated here, P-LA [barcode] 00297049, P photo at ILL). Figure 7.

Lamarck (1783: 19) mentioned individuals communicated to him by "M[onsieur Pierre] Sonnerat" and also noted fruits from M. de Jussieu that he identified as "Acacia vera Aegyptiaca." The Jussieu syntype is indeed annotated as "Acacia vera Aegyptiaca" (P-JU). A second syntype was seen in the Lamarck herbarium (P [barcode] 00297049) (Fig. 7) with a small label at the sheet's lower left that states "*Mimosa arabica* enc. *Acacia* . . . Pluk. t.



Figure 6. Early nontype material of *Acacia skleroxyla* Tussac, *s. coll. s.n.* (P-LA).

251. f 1." in Lamarck's handwriting. The sheet is not ascribed to Sonnerat, but no other specimen identified to this name is extant at P-LA. Both the P-LA and P-JU syntypes correspond to Lamarck's protologue. The plate cited in Plukenet (1696) is also available as further choice for syntype. In order to remove ambiguity, we lectotypify the specimen at P-LA (P [barcode] 00297049), which possesses fruits and leaf material characteristic for the species.

A second label can be seen on the lower right of the P-LA lectotype, which identifies the material as "Herbier de Lamarck" and has the penciled identification as *A. nilotica*. *Acacia arabica* (Lam.) Willd. has been referred as a synonym of *A. nilotica* (L.) Willd. ex Delile [≡ *M. nilotica* L.], an African



Figure 7. Lectotype of *Mimosa arabica* Lam., *s. coll. s.n.* (P-LA).

species adventitive in the New World, especially in the Caribbean (Ross, 1979; Howard, 1988; Bässler, 1998; Ebinger et al., 2000; Rico-Arce, 2007). The name *A. nilotica* (L.) Willd. ex Delile has recently been transferred to *Vachellia nilotica* (L.) P. J. H. Hurter & Mabb., in Mabberley (2008).

7. Zapoteca portoricensis (Jacq.) H. M. Hern., Ann. Missouri Bot. Gard. 73(4): 758. 1986 [1987]. Basionym: *Mimosa portoricensis* Jacq., Collectanea 4: 143–144. 1790. *Acacia portoricensis* (Jacq.) Willd., Sp. Pl., ed. 4, 4(2): 1069. 1806. *Calliandra portoricensis* (Jacq.) Benth., London



Figure 8. Holotype of *Acacia hamiltonii* Desv. ex Ham., *Herb. A. N. Desv. s.n.* (P).

J. Bot. 3: 99. 1844. *Feuilleea portoricensis* (Jacq.) Kuntze, Revis. Gen. Pl. 1: 184, 188. 1891. *Anneslia portoricensis* (Jacq.) Donn. Sm., Enum. Pl. Guatem. 2: 18. 1891. TYPE: Puerto Rico, *Bredemayer 16* (neotype, designated by Hernández [1989: 818], B-W).

Acacia hamiltonii Desv. ex Ham., Prodr. Pl. Ind. Occid. [Hamilton] 59. 1825, as "hamiltonii," nom. illeg. TYPE: Jamaica. *Herb. A. N. Desv. s.n.* (holotype, P [barcode] 00568425). Figure 8.

Acacia linearis Desv. ex Ham., Prodr. Pl. Ind. Occid. 59. 1825, nom illeg., non *Acacia linearis* Sims (1820), non *Acacia linearifolia* A. Cunn. ex Maiden & Blakely

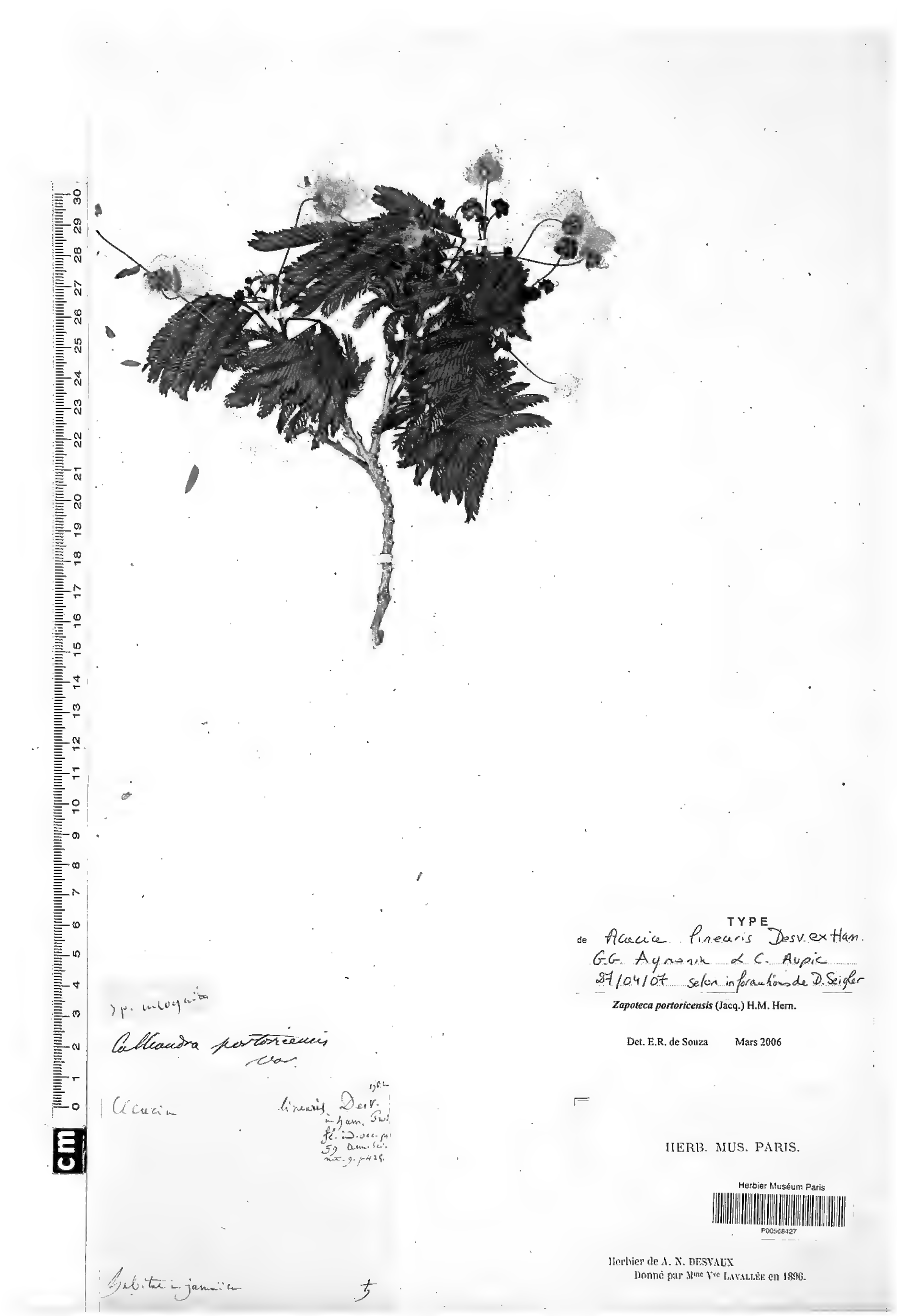


Figure 9. Holotype of *Acacia linearis* Desv. ex Ham., *Herb. A. N. Desv. s.n.* (P).

(1927), non *Acacia linearis* (Wendland) J. F. Macbr. (1919), non *Acacia linearis* Hochr. (1925), non *Acacia linearis* var. *longissima* (H. Wendl.) DC. (1825), non *Acacia linearis* var. *tasmanica* Benth. (1842). TYPE: Jamaica. "Herb. Prof. Desv.," s.d., *Herb. A. N. Desv. s.n.* (holotype, P [barcode] 00588427). Figure 9.

Acacia ungulata Desv., J. Bot. Agric. 3: 68. 1814. TYPE: "Jamaica et Carribaeis," s.d., *s. coll. s.n.*, (holotype, P [barcode] 00568426). Figure 10.

There is only one Jamaican specimen (Fig. 8) in the Desvaux Herbarium (P) that corresponds to that used by Hamilton for his description of *Acacia*



Figure 10. Holotype of *Acacia ungulata* Desv. ex Ham., *Herb. A. N. Desv. s.n.* (P).

hamiltonii in 1825. The sheet bears a small label with "*Acacia* unknown" written on it. At the sheet's lower left is the apparent original label, which notes "Acacia Hamiltonii" and "habitat in Jamaica," attributed to Desvaux, with the number 20602 in the upper right corner, all in the same penmanship. Supporting that Desvaux worked from actual specimen(s) is his annotation "(s.v.)," meaning siccam vidi, at the end of the protologue paragraphs for both *A. hamiltonii* and *A. linearis* Desv., which implies that Desvaux saw material in a dried state.

Additional determinations on the Desvaux type (Fig. 8) for *Acacia hamiltonii* include "*Calliandra an portoricensis* var. ?" on a label above the original, and *Zapoteca portoricensis* (Jacq.) H. M. Hern. "[≡ *Mimosa portoricensis* Jacq.] written on yet a third label by E. R. de Souza in March 2006. *Acacia hamiltonii* has been accepted as *Z. portoricensis* (Hernández, 1986, 1989; Barneby & Grimes, 1996; Barneby, 1998), with the genus *Zapoteca* H. M. Hern. segregated by Bentham (1875) from his larger concept of the mimosoid genus *Calliandra* (Bentham, 1840).

Acacia linearis Desv. was originally described from Jamaica by Hamilton (1825: 59) based on dried material from the Desvaux herbarium, with this indicated in the protologue as "s.v." or siccam vidi. Only a single specimen was located in the Desvaux herbarium (P) that corresponds to the location in Jamaica and to the description of *A. linearis* Desv. The holotype (Fig. 9) bears an original label at the lower left, with the script "*Acacia linearis* Desv., habitat in Jamaica." A number (135?) appears in the upper right corner of this label. There is a small label above this one that notes "sp. incognita." This type for the *A. linearis* specimen is further annotated as "*Calliandra portoricensis* var." in an unknown hand. There is a March 2006 determination slip by E. R. de Souza referring the taxon to *Zapoteca portoricensis* sensu Hernández (1986, 1989).

There is a specimen at P (Fig. 10) that states "hab. en Jamaica et Carribaeis," which represents the original material used to describe *Acacia ungulata* Desv. This habitat statement is at the bottom of what appears to be an original label, which bears the number 181 at the label's upper right, and below which is written "ungulata Desv. j. . . ." All appears to be the same handwriting, possibly that of Desvaux. We consider this to be original material for Desvaux as no other candidate sheets were seen at P. The determination "*Calliandra portoricensis*" appears above, written on a slip of paper added later. A recent determination label is "*Zapoteca portoricensis* (Jacq.) H. M. Hern., E. R. de Souza, Mars 2006." This species is presently known as *Z. portoricensis* (Jacq.) H. M. Hern., 1986, a taxonomic assignment consistent with others (Bentham, 1875; Hernández, 1989; Barneby & Grimes, 1996; Barneby, 1998).

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A New Variety of *Choisya arizonica* (Rutaceae) from Arizona, U.S.A.

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ABSTRACT. A new variety of the evergreen shrub *Choisya arizonica* Standl. (Rutaceae) is described. It differs from the typical form in having longer and broader leaflets and thus larger leaves. The new variety *C. arizonica* var. *amplophylla* Toolin occurs in a few localities in southeastern Arizona with igneous rock substrates, rather than on soils derived from limestone substrates normally colonized by the species.

Key words: Arizona, *Choisya*, IUCN Red List, Rutaceae, United States.

The genus *Choisya* Kunth (Rutaceae) was established in 1823, with the generitype *C. ternata* (La Llave & Lex.) Kunth described from Mexico. Since then, seven species-level names have been published, one of which, *C. dumosa* (Torr.) A. Gray, is represented by three varieties described from northern Mexico (Coahuila, Chihuahua) and extending into New Mexico and Texas. The genus is generally distributed in northern Mexico (Sonora through Coahuila) and adjacent states of the American Southwest. The new variety for *C. arizonica* Standl. is known from Arizona but is distinguished by its association with igneous substrates from the typic variety.

Choisya arizonica Standl., Proc. Biol. Soc. Wash. 27: 222. 1914. TYPE: U.S.A. Arizona: Santa Rita Mtns., limestone ledges, 1350 m, 16 May 1884, *C. G. Pringle s.n.* (type, US-15060).

1a. Choisya arizonica var. **amplophylla** Toolin, var. nov. TYPE: U.S.A. Arizona: Graham Co.: Galiuro Mtns., 1.3 m tall shrub in riparian woodland with *Quercus*, *Acer*, and *Fraxinus*, scattered in patches along Turkey Creek, a riparian canyon within the Aravaipa drainage basin, ca. 1000 m, 22 Apr. 2012, *L. Toolin 3000* (holotype, ARIZ-412732; isotypes, ASU, MO, NY, UC, US).

A *Choisya arizonica* Stand. var. *arizonica* foliolis majoribus (32–42 × 40–75 mm) differt.

Etymology. The new varietal name refers to its leaflets, which are notably (and consistently) larger than those of typical *Choisya arizonica*.

While reviewing the U.S. taxa of the evergreen shrub *Choisya* subg. *Astrophyllum* C. H. Mull. for *Flora of North America*, it became apparent that previous treatments of the genus did not fully account for the morphological variation that exists within *C. arizonica*. Most treatments of American *Choisya* have included three species. *Choisya dumosa* (Torr.) A. Gray occurs in Chihuahua (Mexico), western Texas, and into central New Mexico. *Choisya arizonica* and *C. mollis* Standl., both of which were described by Standley (1914), are endemic to southeastern Arizona. *Choisya arizonica* is distributed from eastern Cochise County west to the Santa Rita Mountains in Santa Cruz County, while *C. mollis* is endemic to western Santa Cruz County, in the Tumacacori, Atascosa, and Pajarito mountains. Benson and Darrow (1981) reduced these two species to varieties under *C. dumosa*. I have found the characters used to separate them (see the key to the taxa) are consistent, no intermediates are known, reproduction in the three varieties is apparently all by rhizomatous cloning, and there are no sympatric populations. As I noted earlier (1986), I have never found a seedling of any *Choisya* in the United States, but sexual reproduction may occur, since I have seen isolated plants at some distance from any others.

Muller (1940) pointed out that some populations of *Choisya arizonica* in the Galiuro Mountains (Pinal and Graham counties), Mustang Mountains (Santa Cruz and Cochise counties) and Rincon Mountains (Pima County) in Arizona included specimens with unusually large leaflets. Such plants have leaflets 40–75 mm long by 3.2–4 mm wide, in marked contrast to typical *C. arizonica*, with the leaflets 20–40 mm long by 1.5–2.5(2.8) mm wide. Leaflets of the new variety are generally even larger than those of *C. mollis* from western Santa Cruz County. Some individuals of the new variety, notably from the eastern slopes of the Rincon Mountains (Pima County), in the Dragoon Mountains (Cochise County), and in the Mustang Mountains (Santa Cruz County), may have leaflet sizes intermediate between those given above. In the northern Galiuro Mountains, along Aravaipa Canyon and its tributaries, where all the rocks are volcanic rhyolites, members of the large

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population of *C. arizonica* var. *amplophylla* there exhibit leaflet size that consistently falls within the larger range given above. This large-leaved form seems consistently distinct enough to warrant varietal status; segregation of the two varieties by substrate types offers further support for recognizing them. Typical *C. arizonica* populations are found on limestone-derived soils; all known populations of *C. arizonica* var. *amplophylla* occur where the rocks are igneous (rhyolite or granite).

Paratypes (all at ARIZ). U.S.A. **Arizona:** Graham Co.: Galiuro Mtns., 7 mi. N of Klondyke, 3100 ft., 9 Sep. 1942, *Darrow s.n.*; Aravaipa Canyon, 10 mi. N of Klondyke, 3100 ft., 9 Sep. 1942, *Darrow s.n.*; Sycamore Canyon, ca. 1/4 mi. below Jackson Cabin rd. crossing, 5 Aug. 1981, *Van Devender & Reichenbacher 746*; Aravaipa Canyon, along edges of walls, 14 Apr. 1936, *Nelson et al. 1002*; Turkey Creek, 1/2 mi. W of confluence with Aravaipa Creek, 8 July 1976, *Bingham 2353*; E mouth of Aravaipa Canyon, 26 Apr. 1969, *Krizman s.n.*; shaded niches, W end of Holy Joe Peak, 22 Aug. 1943, *Darrow s.n.* Pinal Co.: bottom of Virgus Canyon, ca. 5 mi. S of Aravaipa Creek, 30 Mar. 1980, *Warren & Anderson 263*. Pima Co.: Rincon Mtns., E side, along Ash Creek N of confluence with Paige Creek, in riparian woodland dominated by oaks, ca. 1000 m, 14 Apr. 1998, *Toolin & McHargue s.n.*

1b. *Choisya arizonica* Standl. var. ***arizonica***

IUCN Red List category. *Choisya arizonica* var. *arizonica*, as all of its U.S. relatives, seems to have no threats from native or non-native herbivores (livestock). Natural defense against insect and other herbivory probably derives from the fact that the herbage is heavily invested with strongly aromatic oils produced by the glands that are found in the vegetative parts of the plants. I believe no U.S. member of the genus *Choisya* faces a real threat to its existence within our borders. The new variety is assessed as NT, or Not Threatened, according to IUCN (2001) criteria.

Distribution and habitat. All *Choisya* range in elevation from ca. 1000 to 2000 m.

Specimens examined (all at ARIZ). U.S.A., **Arizona:** Cochise Co.: Whetstone Mtns., Middle Canyon, 11 Sep. 1976, *Van Devender & Martin s.n.*; French Joe Canyon, 6 Apr. 1974, *McLaughlin et al. 198*; Dry Canyon, 5400 ft, 28 Aug. 1978, *McLaughlin et al. 1783*; Dragoon Mtns., canyon above Sala Ranch, 5 May 1953, *Goodding 50–53*; Stronghold Canyon, 5000–5200 ft., 29 Apr. 1983, *Daniel 2750*; along Escapule Mine Rd., 1800 m, 10 May 1978, *Reeder & Reeder 6940*; along Middlemarch Rd., 1/4 mi. E of Escapule Mine rd., 880 m, 1 May 1995, *Toolin & McHargue 2257*; s. loc., 10 Apr. 1985, *G. Joseph s.n.*; Cochise Stronghold, ca. 4700 ft., 10 Apr. 1976, *Foley 65*; Bisbee, ca. 5000 ft., 20 Sep. 1929, *Harrison et al. 6100*; Mule Mtns., near Bisbee, 23 May 1928, *Loomis & Peebles 5355*; rocky slopes, 8 Apr. 1950, *Goodding 52–50*; Tombstone Canyon ca. 2 mi. [W of] Mule Pass, 5750 ft., 5 May 1973, *Halse s.n.*; Rocky Canyons, Bisbee, Apr. 1909, *Goodding s.n.*; Mule Mtns., 6000 ft., 10 Oct. 1927, *Crider s.n.*; Tombstone Canyon, 4700 ft., 30 Apr. 1933, *Shreve 6279*; Mule Mtns., 20 July 1894, *Toumey s.n.*; Bisbee, ca. 5000 ft., 20 Sep. 1929, *Harrison et al. 6100*; 8 mi. W of Willcox, Hwy. 86, 4500 ft., *Darrow s.n.* Santa Cruz Co.: Mustang Mtns., steep rocky slope, 19 Apr. 1952, *Goodding 21–52*; Mustang Mtns., 6 Aug. 1969, *Newsome 69–115*; N slope, T20S, R18E, SE1/4 of Sec. 25, 1710 m, Apr. 1986, *Toolin & Starr s.n.*; Harrison Ranch, N end of Mustang Mtns., 9 Nov. 1944, *Darrow et al. 2332*; Sands Ranch, W of San Pedro River, S of Benson, 27 Feb. 1936, *Trogstad 790*; Miller Ranch, T22S, R28E, Sec. 28, Nov. 1970, *Somerville s.n.*; Harrison Ranch, Sonoita–Fairbanks rd., 4900 ft., 9 Nov. 1944, *Darrow et al. 2332*. Pima Co.: Santa Rita Mtns., Helvetia, 31 Mar. 1902, *Kellogg s.n.*; N Santa Rita Mtns., NW1/4, Sect. 19, T18S, R16E, 5 Apr. 1986, *McLaughlin 3341*; 1 1/2 to 2 mi. E of Helvetia, on rd. to mine, 25 Apr. 1953, *Caldwell s.n.*; E slopes of Mt. Fagan near Tucson, Mar. 1914, *Shreve s.n.*; along Gunsite Pass rd. E of Helvetia, limestone canyon, 23 June 1988, *McLaughlin et al. 4694*.

KEY TO U.S. TAXA OF *CHOISYA*

1a. Leaflets (6)8 to 12 per leaf, 10–35 mm long, linear with revolute margins, glabrate or sparsely pubescent; petioles and leaflets with prominent glands ..... *C. dumosa*

1b. Leaflets 3 to 5 per leaf, 35–75 mm long, linear or narrowly elliptic; glands not prominent 2

2a. Leaflets narrowly elliptic, densely pilose; 2.8–4 mm wide; glands not prominent on blade surfaces ..... *C. mollis*

2b. Leaflets linear, sparsely and shortly pubescent along the midnerve on both surfaces; glands elevated but not prominent, on blade surfaces 3

3a. Leaflets 1.5–2.5(2.8) mm wide, 20–40 mm long; plants of limestone substrates ..... *C. arizonica* var. *arizonica*

3b. Leaflets 3.2–4.2 mm wide, 40–75 mm long; plants of igneous subtrates ..... *C. arizonica* var. *amplophylla*

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Cyperus paramoensis (Cyperaceae), a New Sedge Species from Northwestern South America

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Abstract. *Cyperus paramoensis* G. C. Tucker (Cyperaceae) is described from Boyaca, Colombia, as a new species. It occurs in páramo vegetation in the northern Andes of Colombia and Venezuela. Its closest relative is *C. svensonii* G. C. Tucker, from which it differs in its shorter culms, 1–3(–5) cm tall, and dull brown spikelets. This species is placed in *Cyperus* L. subg. *Cyperus* sect. *Umbellati* (C. B. Clarke) Kük., because it has cylindrical spikelets with a winged deciduous rachilla and one or two (three) floral scales.

Resumen. *Cyperus paramoensis* G. C. Tucker (Cyperaceae) se describe como nueva especie de Boyaca, Colombia. Se crece en los páramos de la parte norte de los Andes en Colombia y Venezuela. Su pariente más cercano es *C. svensonii* G. C. Tucker, de la que se distingue en cuanto a sus tallos cortos, 1–3(–5) cm altos, y sus espiguillas de color marrón opaco. Esta especie está clasificada dentro del *Cyperus* L. subgén. *Cyperus* secc. *Umbellati* (C. B. Clarke) Kük., porque tiene espiguillas sido cilíndrica con raquilla caducifolio con alas y uno o dos (tres) escamas florales.

Key words: Colombia, Cyperaceae, *Cyperus*, IUCN Red List, páramo, Venezuela.

The genus *Cyperus* L. (Cyperaceae) includes ca. 800 species, occurring worldwide in warm temperate and tropical regions (Tucker, 1994, 2007). The distributions of individual species range from cosmopolitan, e.g., *C. squarrosus* L. and *C. odoratus* L., to regional and narrow endemics found on all continents, except Antarctica and Europe (Kükenthal, 1935–1936). In the New World, areas of high diversity and endemism for the genus include the southeastern United States, Mexico, the Greater Antilles, and eastern Brazil (Tucker, 2007). While examining unidentified South American specimens of Cyperaceae in the herbaria of the Missouri Botanical Garden, the Field Museum of Natural History, and other institutions, nine collections were recognized as an undescribed species, similar to *C. svensonii* G. C. Tucker. These are described as a new species, *C. paramoensis* G. C. Tucker. Tabular comparisons are made (Table 1), and a key is provided to distinguish the new species from others of the genus in northwestern South America that also have deciduous spikelets and cylindric spikes.

Cyperus paramoensis finds its place in *Cyperus* subg. *Cyperus* sect. *Umbellati* (C. B. Clarke) Kük., an assemblage of ca. 28 species with a pantropical distribution. Such placement is indicated by the following characters used by Kükenthal (1935–1936) to circumscribe this group: spikelets cylindrical, with the rachilla deciduous and winged, floral scales one or two(three), appressed and closely surrounding the achene. The most common species of this section in the New World is *C. aggregatus* (Willd.) Endl.

Cyperus paramoensis G. C. Tucker, sp. nov. TYPE: Colombia. Boyaca: Cañón de Mamarramos, 12 km N of Villa de Leyva, cleared forest area, ca. 3000 m, 5 Feb. 1980, *M. Melampy 781* (holotype, MO). Figure 1.

Haec species *Cypero svensonii* G. C. Tucker affinis, sed ab eo culmis humilibus 1–3(–5) cm altis, spiculis linearibus usque lanceolatis, stylo ca. 0.5 mm longo, stigmatibus ca. 0.7 mm longis atque acheniis anguste oblongis usque ellipsoideis 1.4–1.6 mm longis 0.5–0.6 mm latis apice subacutis base stipitatis differt.

Caespitose perennial; rhizomes 1–3 cm, 3–5 mm diam., knotted, covered with dark brown scales, indurate, oblique; culms bulbous based, 1–3(–5) cm, 1.2–1.5 mm diam., trigonous, smooth. Leaves 3 to 5; sheaths reddish to reddish brown; blades 2–6 cm, 2–2.5 mm wide, inversely W-shaped in cross-section, scabrellate on the margins and veins below. Inflorescence bracts 5 to 8(to 10), (2–)3–7(–12) cm, (1.5–)2.5–4(–6) mm wide, flat to inversely W-shaped, ciliate to scabrellate on the margins and veins, horizontal to ascendent at 30°. Rays absent, the inflorescence a sessile group of 2 to 4 spikes; spikes 5–10 × 6–10 mm, densely flowered, ovoid to ellipsoid in outline shape; the rachis 3–8 mm (not visible when pressed); spikelet bract deltate, ca. 1.2 mm; prophyll ovate, 1.3–2 mm. Spikelets 25 to 35, 3.2–4(–6) × 0.7–0.8 mm, linear to lanceolate,

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Table 1. Comparison of *Cyperus paramoensis* G. C. Tucker with the similar species of northwestern South America: *C. svensonii* G. C. Tucker, *C. pallidicolor* (Kük.) G. C. Tucker, and *C. regiomontanus* Britton.

	C. paramoensis	*C. svensonii*	*C. pallidicolor*	*C. regiomontanus*
Known distributional elevations	(2745–)3100–3930 m	(800–)1200–2400 m	1500–2900 m	0–100(−700) m
Culm heights	1–3(−5) cm	(15–)25–40(−55) cm	(10–)30–50(−80) cm	30–70 cm
Inflorescence bract number, lengths, and orientation	5 to 8(to 10), (2–)3–7(−12) cm, horizontal to ascendent at 30°	(3)4 or 5(6), (3–)10–14(−24) cm, horizontal to reflexed downward	(3)4 to 6(to 8), (3–)10–20(−30) cm, horizontal to reflexed	5 to 8, 2–30 cm, horizontal
Spikes; rachis ranges	densely flowered, ovoid to ellipsoid; rachis 3–8 mm	densely flowered, oblong-ellipsoid to oblong-ovoid; rachis 3–12(−20) mm	loosely flowered, cylindrical; rachis 6–20(−28) mm	densely flowered, narrowly cylindric; rachis 10–23 mm
Spikelet length × width ranges, shapes	3.2–4(−6) × 0.7–0.8 mm, linear to lanceolate	(3.2–)3.6–4.2(−4.5) × (0.7–)0.8–1.1(−1.2) mm, ellipsoid to oblong-ellipsoid	2.4–3.6 × 0.8–1.2 mm, broadly ellipsoid to oblong	3–4(−5.5) × 0.6–0.8(−1) mm, subulate to lanceolate
Spikelet color	dull brown	white to whitish green	golden brown to dull grayish white	dull greenish brown
Anther lengths	0.5–0.6 mm	0.4–0.5 mm	0.6–0.8 mm	0.6 mm
Style × stigma length ranges	0.5 × 0.7 mm	0.6–0.8 × 0.8–1.4 mm	0.8–1.4 × 1.4–2 mm	0.4–0.6 × 1–1.6 mm
Achene length × width ranges	1.4–1.6 × 0.5–0.6 mm	1.5–1.7(−1.8) × 0.6–0.7 mm	1.8–2(−2.2) × (0.6–)0.7–0.9 mm	ca. 2 × 0.4–0.6 mm
Achene shapes	narrowly oblong to ellipsoid, apex subacute, base stipitate	oblong-ellipsoid to ellipsoid, apex acuminate, base stipitate to substipitate	ellipsoid, apex subacute to broadly rounded, base cuneate	narrowly ellipsoid

subquadrate, dull brown; rachilla deciduous, ca. 0.1 mm thick, 0.25 mm wide, flexuous, dull brown, lowermost scales 1.3–1.6 mm apart, wings 0.3 mm wide, hyaline, covering the lower 1/2 of the achene, scales persistent, 1–2(–3), 2.5–3 × 1.5 mm, ovate, mucronulate, laterally strongly 3-nerved, dull whitish green to stramineous, usually with reddish speckles between the veins, medially 3-nerved, greenish stramineous or off-white; stamens 3, filaments 2–2.4 mm, anthers 0.5–0.6 mm, oblong to ellipsoid-oblong, the connective apex to 0.1 mm, whitish brown or pale brown; ovaries with the styles 0.5 mm, stigmas 3, ca. 0.7 mm. Achenes 1.4–1.6 × 0.5–0.6 mm, trigonous, narrowly oblong to ellipsoid, the apex subacute, apiculate from the persistent style base (ca. 0.2 mm), the stipitate base 0.2 × 0.2 mm, the faces concave, the surface puncticulate, brown.

Distribution and habitat. *Cyperus paramoensis* is endemic to high elevations, 2745–3930 m, in the northern Andes, in páramo vegetation. It has been collected from the departments of Boyaca and Cundinamarca in central Colombia and from the state of Mérida in northwestern Venezuela.

IUCN Red List category. Insufficient information is available for the distribution of *Cyperus paramoensis* to assess its conservation status, and the new species is considered as Data Deficient (DD), according to IUCN Red List criteria (2001).

Phenology. *Cyperus paramoensis* has been observed to flower and fruit from July to October, and one fruiting collection is known from February.

Discussion. *Cyperus paramoensis* appears to be closely related to *C. svensonii*, found from 1000 to 2400 m from Chiapas, Mexico, to Ecuador (Tucker, 1994, 2001). Although the distributions of both species seemingly overlap in northwestern South America, *C. svensonii* occurs at lower elevations in pasture or ruderal habitats and has not been recorded from páramo vegetation. None of the known specimens cited as paratypes for *C. paramoensis* had been previously identified to species. *Cyperus paramoensis* can be distinguished by several vegetative and reproductive features, notably the very short culms no more than 5 cm tall, and the small (less than 6 mm), dull brown, linear to lanceolate spikelets. This contrasts with *C. svenso-*

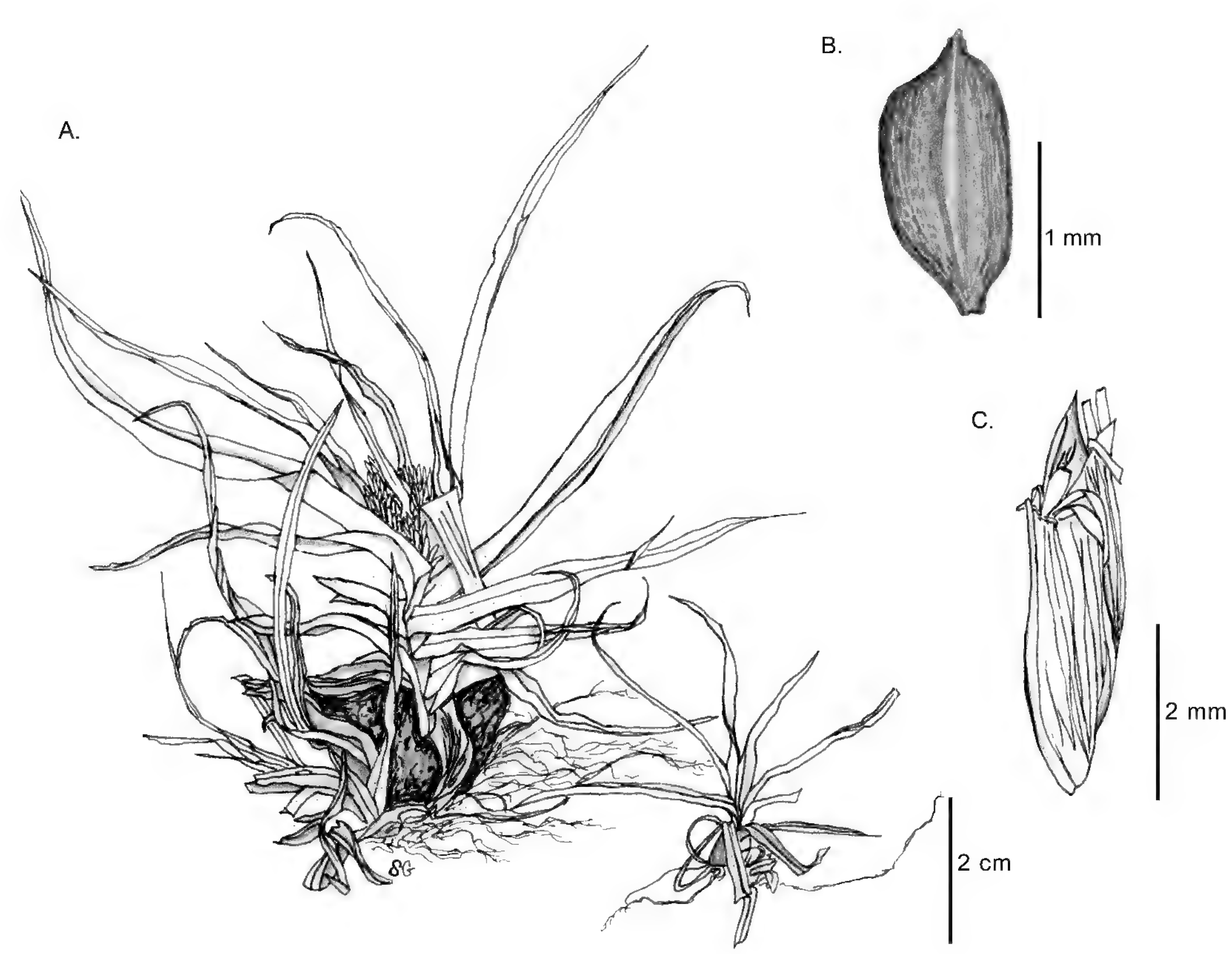


Figure 1. *Cyperus paramoensis* G. C. Tucker. —A. Fertile plant habit. —B. Spikelet. —C. Achene. Original artwork prepared by Sarah Gillespie, from the type *M. Melampy 781* (MO).

nii, a much taller plant with culms typically 25–40 cm tall. Its spikelets are smaller (usually 3.6–4.2 mm) and ellipsoid to oblong-ellipsoid. The new species also differs in shorter styles and stigmas (0.5 mm and 0.7 mm, respectively); in *C. svensonii*, the styles can be longer (0.6–0.8 mm) and the stigmas notably longer (0.8–1.4 mm). I believe the shorter styles and stigmas of *C. paramoensis* indicate that the species is self-pollinating. In *C. paramoensis*, the achenes are slightly smaller (1.4–1.6 mm) than those of *C. svensonii* (1.5–1.7 mm). For additional character and species comparisons see Table 1, which also includes *C. pallidicolor* (Kük.) G. C. Tucker and *C. regiomontanus* Britton. Either might be confused with the new species, especially *C. pallidicolor*, which occurs closer to the elevational range of *C. paramoensis*.

Cyperus paramoensis is one of several, very small species of *Cyperus* (the others are *C. andinus* Palla ex Kük., *C. pennellii* O'Neill & Ben. Ayers, and *C. seslerioides* Kunth) that occur at high elevations in the Neotropics (Tucker, 1994). *Cyperus paramoensis* may be more common than available collections indicate because of the extreme elevation and low stature of the plants.

KEY TO SPECIES OF *CYPERUS* WITH CYLINDRIC SPIKES, DECIDUOUS SPIKELETS, AND PERSISTENT SCALES OCCURRING IN NORTHWESTERN SOUTH AMERICA

1a. Culms hispidulous distally; rays and rachises ..... *C. dentoniae* G. C. Tucker
1b. Culms glabrate (or occasionally with a few prickles on the angles only); rays and rachises glabrous.
  2a. Culms, rays, leaves, and bracts papillose; leaves harshly scabrous on the margins and midveins ..... *C. ligularis* L.
  2b. Culms, rays, leaves, and bracts not papillose; leaves scabrellate or smooth on the margins and midveins.
    3a. At least some spikes borne on rays.
      4a. Spikelets ellipsoid to subulate (2 to 4 times longer than wide), with 1 or 2(3) scales.
        5a. Inflorescence bracts horizontal to reflexed downward and parallel to the culm; spikelet scales laterally golden brown to dull grayish white; spikes 2 to 3 times longer than wide, ± flattened when pressed ..... *C. pallidicolor*

5b. Inflorescence bracts ascendent at about 45°; spikelet scales laterally brown to reddish brown; spikes 2 to 10 times longer than wide, not much flattened when pressed . . . . . *C. mutisii* (Kunth) Andersson

4b. Spikelets linear to narrowly ellipsoid (4 to 10 times longer than wide), with 3 to 8 scales.

6a. Spikelet scales laterally greenish white, the apices overlapping the lower 1/4–1/3 of the next higher scale . . . . . *C. tenuis* Sw.

6b. Spikelet scales laterally light brown, tawny, reddish brown, deep brown, golden brown only rarely/occasionally pale greenish white, the apices barely reaching the base of the next higher scale.

7a. Achenes ellipsoid, sessile or nearly so; stigmas 1–1.5 mm; Pacific slope and mountains . . . . . *C. hermaphroditus* (Jacq.) Standl.

7b. Achenes narrowly oblong, not sessile with stipitate base 0.1–0.2 mm; stigmas (1.5–)2–3(–4) mm; Caribbean slope and lowlands . . . . . *C. thyrsiflorus* Jungh.

3b. Rays absent; spikes all sessile.

8a. Longest inflorescence bract erect; spikes 1(or 2), 3–7 mm . . . . . *C. swartzii* (A. Dietr.) Boeckeler ex Kük.

8b. Longest inflorescence bract slightly ascendent, horizontal, or reflexed; spikes 2 to 10, 5–30 mm.

9a. Spikelets subulate to lanceolate or linear to lanceolate; achenes narrowly ellipsoid to oblong-ellipsoid.

10a. Culms 1–3(–5) cm tall; longest inflorescence bracts 6–12 cm; spikes 5–10 mm; stigmas ca. 0.7 mm; 2745–3930 m, montane Colombia and Venezuela . . . . . *C. paramoensis*

10b. Culms 30–70 cm tall; longest inflorescence bracts 20–30 cm; spikes 10–30 mm; stigmas 1–1.6 mm; sea level to 100(–700) m, Pacific coast . . . . . *C. regiomontanus*

9b. Spikelets ellipsoid or oblong to ellipsoid; achenes ellipsoid to oblong-ellipsoid.

11a. Inflorescence scales laterally whitish to whitish green; stigmas 0.8–1.4 mm; achenes 0.6–0.7 mm wide; Mexican uplands of Chiapas southward to Colombia . . . . . *C. svensonii*

11b. Inflorescence scales laterally stramineous to golden brown; stigmas 1.4–2.1 mm; achenes 0.8–1 mm wide; low (to middle) elevations, widespread from southern U.S.A. to Argentina . . . . . *C. aggregatus*

Paratypes. COLOMBIA. **Boyaca:** Nevado de Cocuy, Quebrada de San Paulino, El Morrón, *J. Cuatrecasas 1377* (COL, F); Nevado de Cocuy, Las Lagunillas, Tabloncito, *J. Cuatrecasas 1598* (COL, F); Nevado del Cocuy, near Río San Pablin, *P. J. Grubb, B. A. B. Curry & A. Fernandez-Perez 138* (CGE not seen, US); Nevado del Cocuy, Quebrada de San Paulino, *J. Cuatrecasas 1406* (COL). **Cundinamarca:** Río de Arobispo, near Bogotá, *F. Pennell 2119* (GH, MO); W slopes of Páramo de Cruz Verde, *J. Cuatrecasas 353* (F); región de Monserrate, El Granizo, *S. Zuluaga 104* (COL). VENEZUELA. **Mérida:** Páramo de la Negra, betw. Bailadores & La Grita, *J. A. Steyermark 57076* (F).

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Dryopteris damingshanensis (Dryopteridaceae): A New Fern in Subgenus *Nothoperanema* from Guangxi, China

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ABSTRACT. *Dryopteris damingshanensis* Li Bing Zhang & H. M. Liu, a new species of the fern genus *Dryopteris* Adans. (Dryopteridaceae) from central Guangxi, China, is described and illustrated. *Dryopteris damingshanensis* is one of the seven species known in *Dryopteris* subg. *Nothoperanema* Tagawa sect. *Nothoperanema* (Tagawa) Li Bing Zhang, and a taxonomic key to these species is provided. The new species is most similar to *D. shikokiana* (Makino) C. Chr. but is distinct by the following characters: leaves bipinnate-pinnatisect, leaf texture papery, petiole scales dark brown, and basiscopic pinnules as large as acroscopic pinnules. *Dryopteris damingshanensis* is currently known only from a single population occurring at Daming Shan in central Guangxi, China, and is considered to be Critically Endangered (CR), based on IUCN Red List criteria.

Key words: *Dryopteris*, Guangxi, IUCN Red List, section *Nothoperanema*, subgenus *Nothoperanema*.

When the second author (H.-M. L.) was working on her dissertation of a phylogeny of the Dryopteridaceae (Liu et al., 2007), she collected a species of *Nothoperanema* (Tagawa) Ching or *Dryopteris* subg. *Nothoperanema* Tagawa (Dryopteridaceae) from Daming Shan in central Guangxi, China, initially identifying it as *N. shikokianum* (Makino) Ching. The *rbcL* sequence of this accession in GenBank, as generated by Liu, was then used by the first author (L.-B. Z.) in two recent phylogenetic studies of *Dryopteris* Adans. (Zhang & Zhang, 2012; Zhang et al., 2012). When included among multiple accessions of *N. shikokianum*, Liu's *rbcL* sequence from the Guangxi collection is clearly different from accessions from Sichuan and Yunnan in China as well as in Japan. Subsequent examination of the voucher specimen of Liu's collection at PE in March 2012 by the first author confirmed that its morphology was distinctive from that of the closely similar *N. shikokianum* [≡ *D. shikokiana* (Makino) C. Chr.], and Liu's collection represents a species new to science and is described herein.

Dryopteris damingshanensis Li Bing Zhang & H. M. Liu, sp. nov. TYPE: China. Guangxi Zhuang Autonomous Region: Wuming Co., Daming Shan, ca. 23°9′N, 108°11′E, alt. 1250 m, 27 May 2004, *H. M. Liu GX241* (holotype, PE-01450383). Figure 1.

Diagnosis. *Dryopteris damingshanensis* is similar to *D. shikokiana*, but the new species is distinguished by bipinnate-pinnatisect leaves, a papery leaf texture, dark brown petiole scales, and basiscopic pinnules as large as acroscopic pinnules.

Terrestrial ferns 70–90 cm tall. Leaves caespitose, 3 to 5 leaves per rhizome; petiole 35–45 cm × ca. 3 mm, scaly, canaliculate adaxially; basal petiole scales narrowly ovate to lanceolate, to 2.6 mm, to 0.6 mm wide, thickly papery, dark brown, entire or nearly entire on margin; distal petiole scales smaller, lanceolate to linear, papery, dark brown, entire on margin; leaf lamina deltate to ovate, papery, 28–35 cm long, 20–30 cm at base, not contracted toward base, bipinnate-pinnatisect, apex acuminate to attenuate; rachis ca. 1.5 mm diam., reddish brown, sparsely scaly, the scales linear or narrowly lanceolate, reddish brown; pinnae 5 to 8 pairs, broadly lanceolate to lanceolate, basalmost single pair nearly opposite, upper pinnae alternate, with stalk to 0.8 cm, obliquely ascending, adjacent to one another, base asymmetrical, caudate-acuminate at apex, bipinnatifid; basalmost pinnae largest, 15–21 cm, 6–8 cm at base; upper pinnae 5–15 cm long, 1.8–6

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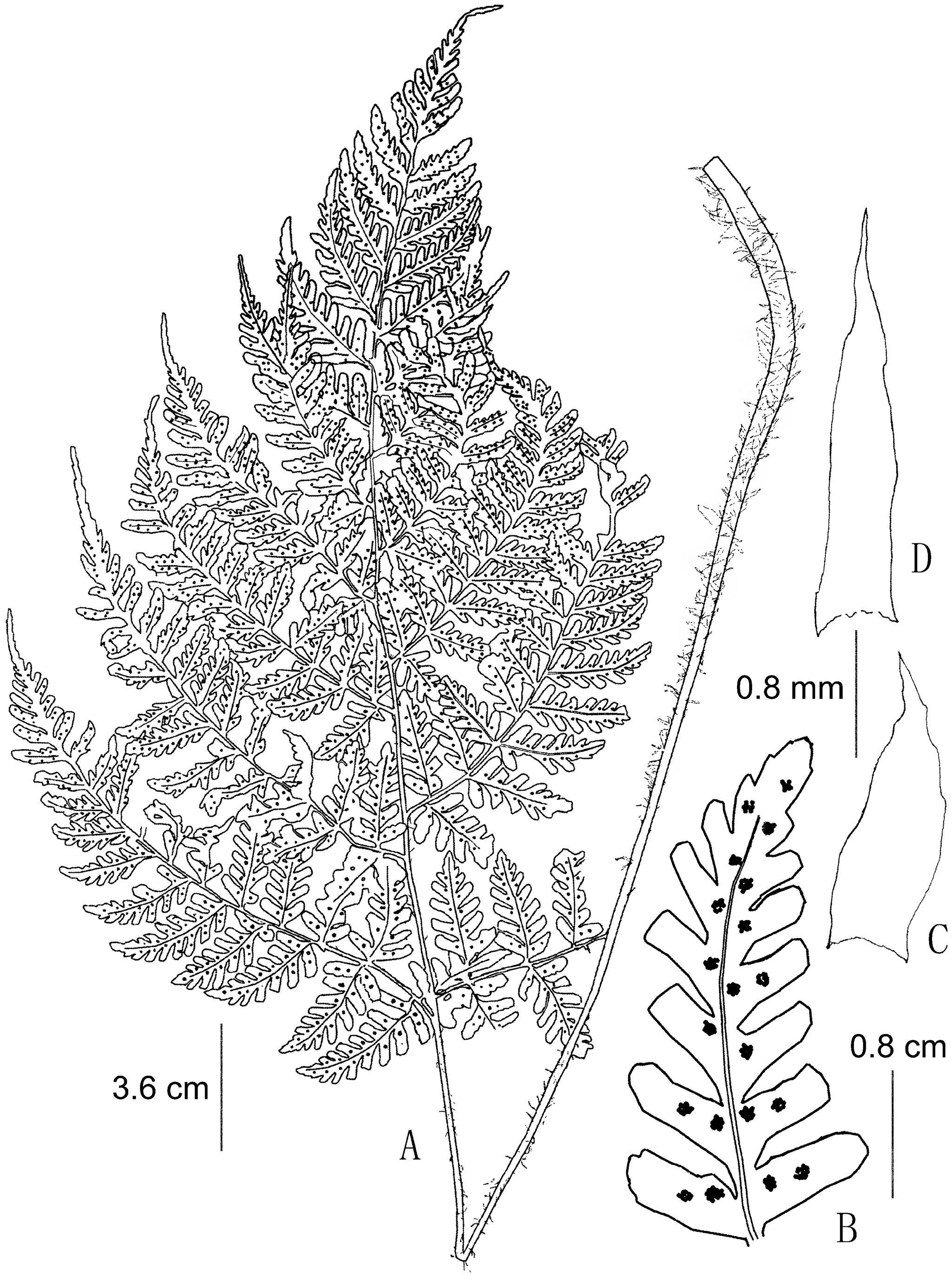


Figure 1. *Dryopteris damingshanensis* Li Bing Zhang & H. M. Liu. —A. Habit. —B. Pinnule. —C. Basal petiole scale. —D. Distal petiole scale. Drawings by Li-Bing Zhang taken from the holotype *H.-M. Liu GX241* (PE).

cm at base; pinna rachis ca. 0.7 mm diam., adaxially canaliculate, scales reddish brown, linear; pinnules ca. 10 pairs, narrowly ovate, not contracted toward base, to 4 × 2 cm, alternate, rounded at base, accuminate at apex, sessile but lower pairs with winged rachis to 0.2 cm, 1-pinnatisect, basiscopic pinnules as large as acroscopic ones; adaxially with ca. 15 setae, these lanceolate, clear-colored, squa-

mate setae denser along pinnule rachis and at forking positions of midribs; lobes in 5 to 8 pairs, oblong, to 8 × 3 mm, truncate or sometimes rounded at apex, entire or nearly entire; dark brown when dry, adaxially with clear setae, abaxially with sparse microscales; microscales brown, hairlike; pinnule venation pinnate; veinlets in ultimate lobes simple or forked, running to frond margins, visible abaxially. Sori round, 0.7–1.1 mm diam., to 5 mm apart from each other, brown when mature, terminal on veinlets, 4 to 7 pairs on each pinnule in 1 (rarely 2) row(s) at each side of midrib, close to midrib; exindusiate. Number of spores per sporangium not known.

Distribution and habitat. *Dryopteris damingshanensis* was found on the western slope/face of Daming Shan in Wuming County, central Guangxi, China. Populations might also be found in the eastern, northern, and southern sides of Daming Shan, as well as in the adjacent Shanglin, Mashan, and Binyang counties, respectively, which Daming Shan extends across, and in neighboring counties in central Guangxi, China. *Dryopteris damingshanensis* was observed to grow in evergreen forests in acidic red soils derived mainly from phyllite, quartz, and shale, under evergreen forest at an elevation of ca. 1250 m.

IUCN Red List category. Only one population at a single locality on Daming Shan with fewer than 30 individuals was found. Based on the evidence available, *Dryopteris damingshanensis* should be classified as Critically Endangered, or CR, according to the International Union for Conservation of Nature and Natural Resources guidelines (IUCN, 2008). Although the habitat of *D. damingshanensis* in Wuming County is inside the national Daming Shan Nature Reserve and thus is relatively well protected, detailed investigation of the species' population dynamics is needed to best assess its vulnerability.

Etymology. The epithet of the new species is taken from the Chinese pinyin *damingshan*, the name of the mountain in central Guangxi, China, where the type was collected.

Discussion. Based on molecular data, the fern genus *Nothoperanema*, though widely accepted as a genus (e.g., Pichi-Sermolli, 1977; Ching, 1978; Kuo, 1985; Wu & Ching, 1991; Hsieh, 2000; Roux, 2011), should be subsumed under *Dryopteris* (Geiger & Ranker, 2005; Zhang & Zhang, 2012; Zhang et al., 2012). *Nothoperanema* shares all diagnostic features of *Dryopteris* such as the reniform indusia, short rhizomes, and catadromous arrangement of leaf segments seen in most species. In view of the presence of the clear-colored, squamate setae on the adaxial surface of pinnules, *D. damingshanensis* is clearly a member of *Dryopteris* sect. *Nothoperanema* (Tagawa) Li Bing Zhang (Zhang & Zhang, 2012). Including *D. damingshanensis*, there are only seven species known in *Dryopteris* sect. *Nothoperanema*, which are distributed across eastern, northeastern, and southern Asia, and from central, southern, and eastern Africa, the Himalayas, Madagascar and the Mascarene Islands (including Réunion Island), New Guinea, and Polynesia, including the Hawaiian Islands (Zhang & Zhang, 2012). In addition to the new species, the members of *Dryopteris* sect. *Nothoperanema* include *D. diacalpioides* (Ching) Li Bing Zhang, *D. grandifrons* Li Bing Zhang, *D. hendersonii* (Bedd.) C. Chr., *D. rubiginosa* (Brack.) Kuntze, *D. shikokiana*, and *D. squamiseta* (Hook.) Kuntze. *Dryopteris damingshanensis* is most similar to *D. shikokiana* in having deltate to ovate lamina and exindusiate sori. However, the differences between *D. damingshanensis* and *D. shikokiana* are obvious. *Dryopteris damingshanensis* has bipinnate-pinnatisect leaves, papery leaf texture, dark brown petiole scales, and basiscopic pinnules that are as large as acroscopic pinnules. In contrast, *D. shikokiana* has tetrapinnatifid leaves, thinly papery leaf texture, reddish brown petiole scales, and basiscopic pinnules that are clearly larger than acroscopic pinnules. The remaining five species of *Dryopteris* sect. *Nothoperanema* have indusiate sori. The seven known species of *Dryopteris* sect. *Nothoperanema* can be distinguished from one another by the following key (modified from Hsieh, 2000; Zhang & Zhang, 2012).

KEY TO SPECIES OF *DRYOPTERIS* SECT. *NOTHOPERANEMA*

1a. Rachis scales narrowly subulate.
  2a. Plant 60–110 cm tall; basalmost pinnae 14–21 cm long; primary pinnules 5–7 cm; secondary pinnules 1–1.6 cm.
    3a. Rachis scales nearly black when dried; pinnae acute at apices ..... *D. squamiseta*
    3b. Rachis scales brown to rust colored when dried; pinnae acute or obtuse at apices.
      4a. Plant 60–70 cm tall; pinnae obtuse at apices; middle pinnae ca. 3 cm wide ..... *D. diacalpioides*
      4b. Plant 70–100 cm tall; pinnae acute at apices; middle pinnae to 3.5 cm wide ..... *D. rubiginosa*
  2a. Plant 120–150 cm tall; basalmost pinnae to 38 cm long; primary pinnules to 17 cm long; secondary pinnules to 2 cm long ..... *D. grandifrons*
1b. Rachis scales lanceolate to linear.

5a. Sori indusiate; rachis scales reddish brown; ultimate pinnule segments serrate at apices ..... *D. hendersonii*
5b. Sori exindusiate; rachis scales reddish brown or dark brown; ultimate pinnule segments entire or undulate apically.
6a. Leaves tripinnate-pinnatifid; leaf texture thinly papery; petiole scales reddish brown; basiscopic pinnules clearly larger than acroscopic pinnules ..... *D. shikokiana*
6b. Leaves bipinnate-pinnatisect; leaf texture papery; petiole scales darkish brown; basiscopic pinnules as large as acroscopic pinnules ..... *D. damingshanensis*

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Nomenclatural Notes for *Fritillaria pyrenaica* (Liliaceae) in the Iberian Peninsula

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Abstract. The nomenclature of the new combination *Fritillaria pyrenaica* L. subsp. *falcata* (E. Rico) R. Alonso, de Paz & M. E. García (Liliaceae) is presented. The taxon, endemic to the Iberian Peninsula, was initially described under the illegitimate later homonym *F. falcata* Caball. Herein, we correct the authorities of the basionym *F. lusitanica* Wikstr. f. *falcata* (Caball.) E. Rico and the replaced synonym *F. nervosa* Willd. subsp. *falcata* (Caball.) Fern.-Arias & Devesa.

Key words: *Fritillaria*, Liliaceae, Spain.

In 1947, Caballero described the species *Fritillaria falcata* Caball. (Liliaceae) on the basis of specimens with falcate and longitudinally folded leaves from the Peña de Francia mountainous area in the province of Salamanca in the center of Spain (Caballero, 1947). According to Article 53.1 of the International Code of Botanical Nomenclature (ICBN; McNeill et al., 2006), this is an illegitimate name because it is a later homonym of *F. falcata* (Jeps.) D. E. Beetle. Beetle's name was based on *F. atropurpurea* Nutt. var. *falcata* Jeps. (Jepson, 1922; Beetle, 1944) and included specimens from western California in the United States. The name *F. falcata* Caball. was later transferred first at the rank of form and later at the rank of subspecies. Rico Hernández (1985) treated this taxon as *F. lusitanica* Wikstr. f. *falcata* (Caball.) E. Rico, noting that the diagnostic characteristics of the species given by Caballero were quite variable.

Later, in a monograph on the genus *Fritillaria* L., Fernández-Arias González and Devesa (1990a) published the intended new combination, *F. nervosa* Willd. subsp. *falcata* (Caball.) Fern.-Arias & Devesa, based on the morphology of the nectary, which is considered taxonomically significant in the genus. Nectaries of *F. lusitanica* are oblong, while in *F. nervosa* these are rounded, just as they are in the taxon here considered. In both combinations, no account was taken in regard to the illegitimate status of the basionym of the form and variety. Hence, although the epithet *falcata* is available for use at the ranks of form and variety in these two species, the authorship to Caballero is incorrect. According to Article 58.1 of the ICBN (McNeill et al., 2006), the

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name for the form is to be treated as a new name with the same type as *F. falcata* Caball. but with priority from the date of publication of the new name. *Fritillaria lusitanica* f. *falcata* was published as an intended new combination based on *F. falcata* but is in fact a replacement name for Caballero's illegitimate *F. falcata*. Fernández-Arias González and Devesa (1990a) cited the illegitimate *F. falcata* as the basionym of their new combination, but under ICBN Article 33.7 (c) (McNeill et al., 2006; see also Ex. 22), this is an error to be corrected, and the name is validly published as a new combination with the basionym *F. lusitanica* f. *falcata* E. Rico. Thus, the correct authorities for these names would be *F. lusitanica* f. *falcata* E. Rico and *F. nervosa* subsp. *falcata* (E. Rico) Fern.-Arias & Devesa, respectively.

Peruzzi and Jarvis (2009) provided a lectotype for the Linnaean name *Fritillaria pyrenaica* L. using material from the Burser Herbarium at UPS and proposed its use to designate an endemic plant from the north of Spain and the south of France. This name had been considered a nomen confusum by other authors, since the sheet initially included by Linnaeus in the Linnaean Herbarium at LINN is not identifiable with the present-day concept of *F. pyrenaica* (López González, 1986). Hence, Fernández-Arias González and Devesa (1990a) proposed the use of *F. nervosa* and added the epithet *falcata* applied at the subspecies rank under this name, providing a lectotype from material in the Bouché Herbarium at W for *F. nervosa*. Rix (1980) in *Flora Europaea* treats the taxon as *F. pyrenaica* at the rank of species without any subspecies.

Various authors of chorology and taxonomic works have recognized the name *Fritillaria nervosa* subsp. *falcata* (Fernández-Arias González & Devesa, 1990b; Sardinero, 2004; Paz et al., 2011). Additionally, this name appears in official listings for the protection of threatened Spanish flora. The rarity and restricted distribution of this plant have led to considerable interest in its conservation. In the *Atlas and Red Book of Spanish Vascular Flora* [*Atlas y Libro Rojo de la Flora Vascular Española*] by Bañares et al. (2004) as well as in the *Red List of Spanish Vascular Flora* [*Lista Roja de la Flora Vascular Española*] by Moreno (2008), the taxon is considered as Vulnerable (VU). At the regional level, in the *Catalogue of Protected Flora for Castile and Leon* [*Catálogo de Flora Protegida de Castilla y León*] (Anonymous, 2007), it appears in appendix III, which lists species rated as requiring preferential treatment [De Atención Preferente].

Recently, a nomenclatural proposal has been published in which *Fritillaria nervosa* subsp. *falcata* is designated as *F. caballeroi* F. M. Vázquez (Vázquez, 2009). This restored the original species-level recognition for the taxon; however, the author did not offer any justification for rejecting the subspecific rank most generally used in the past (e.g., Rico Hernández, 1985; Fernández-Arias González & Devesa, 1990a). *Fritillaria caballeroi* is a legitimate replacement name at species rank, and the taxon has appeared under this name in the addenda of the recent checklist for endangered plant species from Spain (Bañares et al., 2010) and was assessed under the category of Vulnerable (VU).

The affinity of *Fritillaria caballeroi* [≡ *F. nervosa* subsp. *falcata*] to *F. pyrenaica*, a taxon from which it is distinguished by the smaller flowering scapes and the longitudinally folded, falcate leaves, justify the treatment of this taxon at the subspecific level, as seen appropriately by Fernández-Arias González and Devesa (1990a). Because *F. pyrenaica* L. (1753) has priority of publication over *F. nervosa* Willd. (1809), the combination below is proposed to designate this taxon.

1. Fritillaria pyrenaica L., Sp. Pl. 304. 1753. TYPE: Basileae in horto Eckenstenii. Habitat in Pyrenaeis, s.d. Herb. Burser III: 62 (lectotype, designated by Peruzzi & Jarvis [2009: 1360], UPS).

1a. Fritillaria pyrenaica subsp. **falcata** (E. Rico) R. Alonso, de Paz & M. E. García, comb. et stat. nov. Basionym: *Fritillaria lusitanica* Wikstr. f. *falcata* E. Rico, Anales Jard. Bot. Madrid 41(2): 417. 1984 [1985], replacement name for *F. falcata* Caball., Anales Jard. Bot. Madrid 7: 650–651. 1948, nom. illeg., non *F. falcata* (Jeps.) D. E. Beetle, Madroño 7(5): 148. 1944. *Fritillaria nervosa* Willd. subsp. *falcata* (E. Rico) Fern.-Arias & Devesa, Stud. Bot. Univ. Salamanca 9: 62–63. 1990 [1991]. *Fritillaria caballeroi* F. M. Vázquez, Folia Bot. Extremadur. 4: 122. 2009, replacement name for *F. falcata* Caball. TYPE: Spain. Salamanca: en la Peña de Francia, La Alberca, en tierra humosa, suelta, en las oquedades de las rocas de la cima, con *Gagea foliosa* Schult. f., 23 May 1947, *A. Caballero s.n.* (lectotype, designated by Fernández-Arias González & Devesa [1990a: 58], MA-21354).

This taxon is endemic and exclusively occurs in the center and north of Spain. *Fritillaria pyrenaica* subsp. *falcata* has been collected in the provinces of Salamanca, Ávila, and Cáceres, and more recently recorded in the province of León (Paz et al., 2011).

KEY TO *FRITILLARIA PYRENAICA* IN SPAIN

1a. Lanceolate, falcate, and longitudinally folded leaves; scapes 13–24 cm . . . . . *F. pyrenaica* subsp. *falcata*

1b. Lanceolate or linear-lanceolate, straight and flat leaves; scapes 15–55 cm . . . . . *F. pyrenaica* subsp. *pyrenaica*

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Dichapetalum coronadoae, a New Species of Dichapetalaceae from Nicaragua

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ABSTRACT. *Dichapetalum coronadoae* Arbeláez & W. D. Stevens (Dichapetalaceae) from the Bosawas Biosphere Reserve in the department of Jinotega, Nicaragua, is found to be new. A morphological description, diagnosis, and illustration are provided. This new species is superficially most similar to, and has been confused with, *D. bullatum* Standl. & Steyerm.

Key words: Bosawas, Central America, Dichapetalaceae, *Dichapetalum*, IUCN Red List, Nicaragua.

Dichapetalum Thouars (Dichapetalaceae) is a relatively rare genus in Nicaragua. Based on a total of six collections, Prance (2001) was able to produce a floristic treatment including six species: *D. axillare* Woodson and *D. bullatum* Standl. & Steyerm. with one collection each, *D. morenoi* Prance and *Dichapetalum* "sp. A" (Prance, 2001: 801) with two collections each, *D. grayumii* Prance and *D. pedunculatum* (DC.) Baill., as expected members of the flora. Today, there are a total of 20 collections of the genus known from Nicaragua, and the species are thus a little better understood. *Dichapetalum grayumii* is now definitely known from the flora, *D. moralesii* Prance has been added to the flora, and *Dichapetalum* "sp. A" has been identified as *D. nervatum* Cuatrec.

However, the single sterile collection of *Dichapetalum bullatum* mentioned by Prance (2001: 800) was always suspicious, being disjunct from Guatemala (the type locality of *D. bullatum*) and differing in habit (liana), stipule margins (fimbriate), and leaf surface (bullate). Four additional collections of this taxon from the same general area in Nicaragua as the original, two flowering and two sterile, have shown that the differences between it and *D. bullatum* are consistent, and the flowering material has provided additional conspicuous differences. Comparison with the type material of *D. bullatum* has convinced us that the Nicaraguan material is definitely not that species, and study of other treatments of *Dichapetalum* (Prance, 1972, 1988, 1993, 1997, ined., Prance et al., 2010) makes it clear that this is an unnamed species. *Dichapetalum bullatum* is now known from Guatemala and Honduras; it may eventually be found in northern Nicaragua but is currently excluded from the flora.

Dichapetalum coronadoae is here compared with *D. bullatum*, to which it is most similar and with which it has been confused. However, most keys to tropical American *Dichapetalum* start with the contrast of trees with entire stipules versus lianas with fimbriate stipules, and these two species fall on opposite sides of this contrast. In practice, neither of these contrasts, tree or liana and stipules entire or fimbriate, are quite as clear as they sound, and are not always correlated. In diagnostic terms, the species probably closest to *D. coronadoae* is *D. mexicanum* Prance, a tree with fimbriate stipules (Prance, 1988). *Dichapetalum mexicanum* is apparently only known by the type collection from Veracruz, Mexico, and it differs from *D. coronadoae* by the size and shape of the leaves, the fimbriate stipules, the heterotrichous indument on sepals and the three styles (connate nearly to apex) conspicuously exerted above the lanate portion of pistil, among other differences.

Dichapetalum coronadoae Arbeláez & W. D. Stevens, sp. nov. TYPE: Nicaragua. Jinotega: Mpio. de Wiwilí, Reserva Biológica de Bosawas, camp. Painkira, caño arriba de Pilawás, 14°19′N, 085°06′W, 176 m, 6 May 2008, *I. Coronado G. & A. Fernández 4694* (holotype, MO; isotypes, F, HULE, US). Figure 1A–I.

Diagnosis. Most similar to *Dichapetalum bullatum* Standl. & Steyerm., from which it differs most obviously by having an arborescent rather than a lianescent habit, sparsely dentate rather than fimbriate stipules, plane rather than bullate leaves, and homotrichous rather than heterotrichous inflorescence branches and sepals.

Trees or shrubs (1)4–12 m tall; branches densely hirsute distally, somewhat glabrescent, bark lenticelate on mature branches. Leaves with the lamina 11–30.5 × 6.5–13.7 cm, obovate to elliptic, base cuneate-attenuate, oblique, rounded, or rarely subcordate, margins entire, apex apiculate, the acumen (2)8–11(15) mm, texture membranous, both surfaces plane, pubescent throughout but more abundantly so on the veins below and on the margins, midrib

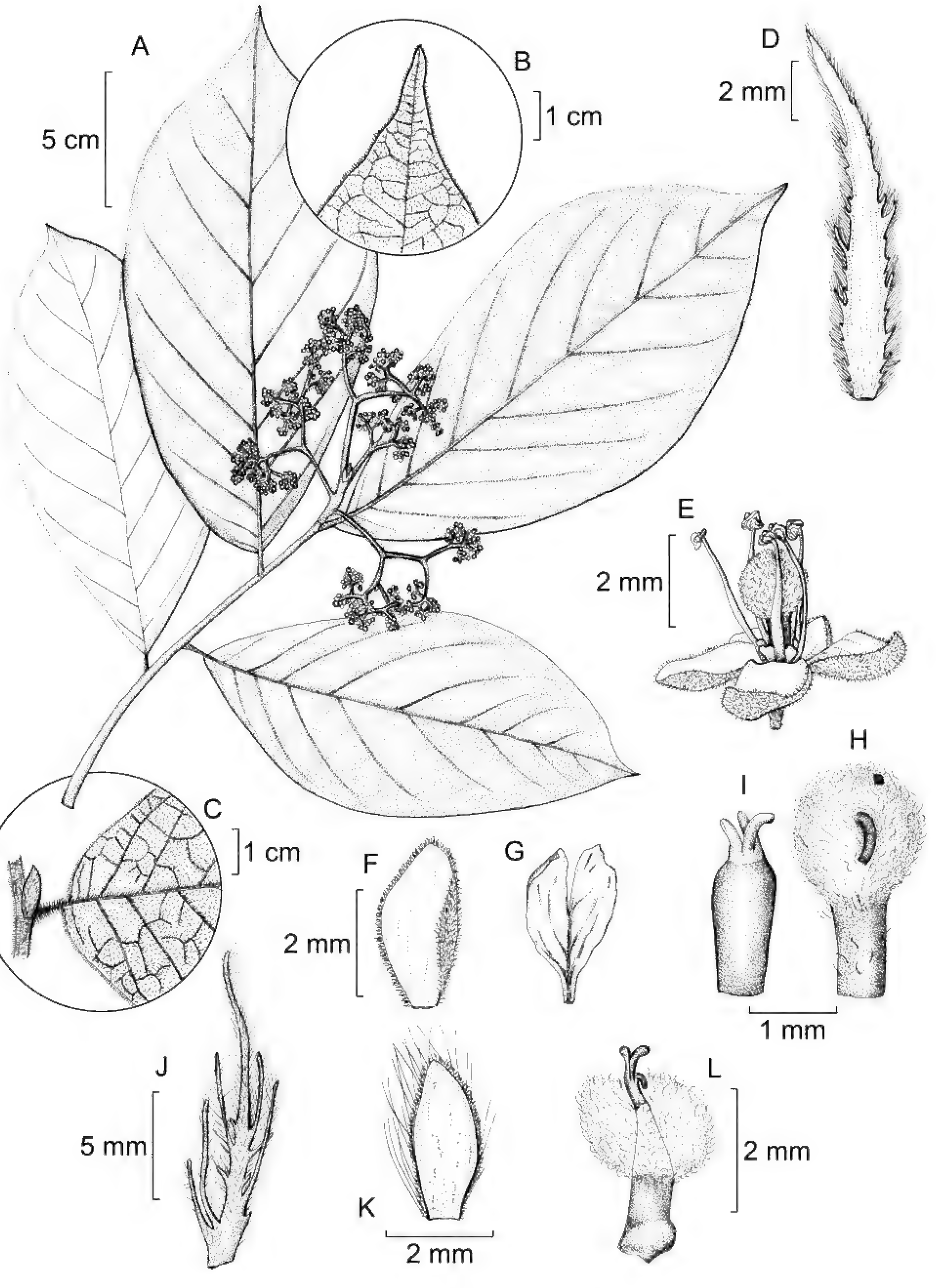


Figure 1. A–I. *Dichapetalum coronadoae* Arbeláez & W. D. Stevens. —A. Flowering branch. —B. Leaf apex. —C. Leaf base. —D. Stipule. —E. Flower with petals removed. —F. Sepal. —G. Petal. —H. Pistil with tomentum. —I. Pistil with tomentum removed. A and I are illustrated from the type *I. Coronado G. & A. Fernández 4694* (MO); B–H are taken from *I. Coronado G. & A. Fernández 4027* (US). J–L. *Dichapetalum bullatum* Standl. & Steyerm. —J. Stipule. —K. Sepal. —L. Pistil with tomentum. J–L are drawn from the type *Steyermark 39874* (F).

slightly impressed and moderately pubescent above, elevated and densely pubescent below, primary veins (5)6 to 8, slightly elevated below and pubescent; petiole 7–12 mm, hispid; stipule lanceolate, (6–)8.5–17 mm long, subpersistent, abaxially hispid, the hairs covering the entire surface including the margins, with a few trichomes on the basal third of the adaxial side, margins sparsely dentate. Inflorescences panicles, up to 8 cm long, dichotomously branched, terminal on main axes or on subterminal lateral branches, tomentulose, bracts and bracteoles lanceolate, shallowly dentate, abaxially hispid. Flowers hermaphroditic, pedicels 0.5–1 mm; sepals five, 2.5–3.1 × 1.1–1.7 mm, gray tomentulose; petals 5, free,

Table 1. Differences between *Dichapetalum coronadoae* and *D. bullatum*.

	D. coronadoae	*D. bullatum*
Habit	trees or shrubs	vine or shrubby vine
Leaf surfaces	plane	bullate
Inflorescence	up to 8 cm long, distally dichotomously branched	2–3 cm long, branched at base
Stipules	sparsely dentate	fimbriate
Pedicels	0.5–1 mm long	5–6 mm long
Inflorescence	branches and sepals homotrichous	heterotrichous
Gland apex	shallowly lobed	entire, rounded
Styles	2 or 3, in herbarium material hidden in the lanate portion of pistil (Fig. 1H)	3, conspicuously exerted above the lanate portion of pistil (Fig. 1L)

broadly obtrullate in outline, 2.6–3.3 × ca. 2 mm, glabrous, yellowish white, bifid, the split slightly less than half of the petal length, each resulting lobe cucullate; stamens five, 3.1–4.3 mm, all fertile, alternating with and exceeding the corolla lobes; disc of 5 knob-shaped glands, 0.5–0.7 mm, shallowly lobed apically, free, glabrous. Ovary bi- or trilocular, with 2 ovules in each loculus, lanate except for glabrous base, styles 2 or 3. Fruit not seen.

This species seems closely related to *Dichapetalum bullatum* but is easily distinguished by its arborescent habit (vs. vines or shrubby vines), plane upper leaf surface (vs. bullate), sparsely dentate stipules (vs. fimbriate, see Fig. 1J), and tomentulose inflorescence branches and sepals (vs. tomentulose and hispid, see Fig. 1K). For additional morphological differences see Table 1.

Distribution and ecology. *Dichapetalum coronadoae* has been collected in flower from May to June in north-central Nicaragua.

IUCN Red List category. If one were to carefully analyze *Dichapetalum coronadoae* using the IUCN categories (IUCN, 2001), it would surely be considered Data Deficient (DD). The area of occupancy suggested by the five known collections is relatively small but is entirely within a biosphere reserve. The Bosawas reserve, however, is being rapidly deforested, and not enough is known of the ecology of the species to speculate on how well it adapts to secondary vegetation. This species is currently a political endemic of north-central Nicaragua, but since it is on the Honduran border and the Río Coco is no barrier to plant distributions, it certainly occurs and could be found in the neighboring country.

Etymology. This species was named after Indiana Coronado González, collector of the type, whose botanical exploits in Bosawas are legendary.

Paratypes. NICARAGUA. **Atlántico Norte:** Cerro Baká, ca. 6.5 km E of Río Coperna, lower mtn. slopes & secondary areas, 13°40′N, 084°30′W, 200–300 m, 19 Mar. 1979, *J. Pipoly 4929* (MO). **Jinotega:** Mpio. Wiwilí, Reserva Biol. Bosawas, comun. Inipuwás, área de cacería, alrededores del transecto Ialnú, 14°24′N, 085°09′W, 165 m, 10 June 2007, *I. Coronado G. & A. Fernández 4027* (F, HULE, K, MO, US); Mpio. Wiwilí, Reserva Bosawas, Río Coco, poblado de Walaquitan, Cerro Muzu, 13°33′N, 085°47′W, 300–452 m, 8 Sep. 1997, *R. Rueda & I. Coronado 7273* (HULE, MO); Mpio. Bocay, Reserva Bosawas, Macizo Caliso de Wizo, al sureste de la comunidad de Wizo, 13°59′N, 085°19′W, 200–500 m, 17 Feb. 1998, *R. Rueda 7835* (HULE, MO).

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Centaurea aytugiana (Asteraceae), a New Species from North Anatolia, Turkey

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Abstract: A new species in *Centaurea* L. (Asteraceae) from Turkey is described and illustrated. *Centaurea aytugiana* Bancheva, Kaya & Binzet grows in Karabük Province, North Anatolia, Turkey, and its morphologically allied species are *C. stenolepis* A. Kern. and *C. salicifolia* M. Bieb. ex Willd. The chromosome number of *C. aytugiana*, $2n = 30 + 1B$, counted in root tips, is reported and illustrated. Pollen is described, using both light and scanning electron microscopy, and the pollen grains correspond to Wagenitz's *Jacea*-type. The new species is currently known from a single locality in Karabük Province and is assessed as Critically Endangered (CR), according to IUCN criteria.

Key words: Asteraceae, *Centaurea*, IUCN Red List, Turkey.

Centaurea L. is one of the largest genera in Asteraceae, comprising from 200 to 700 species, depending on the classification used (Bremer, 1994; Hellwig, 2004; Bancheva & Greilhuber, 2006). Turkey is one of the main centers of diversity for the genus (Wagenitz, 1986), and for the *Flora of Turkey*, 172 species plus six imperfectly known species of *Centaurea* were previously accepted (Wagenitz, 1975). Since then, 32 new species have been described or newly reported (Davis et al., 1988; Agababian, 1997; Güner et al., 2000; Duran & Duman, 2002; Greuter, 2003; Türkoğlu et al., 2003; Aytaç & Duman, 2005; Uzunhisarcıklı et al., 2005, 2007; Vural et al., 2006; Wagenitz et al., 2006; Eren, 2007; Kaya & Vural, 2007; Uysal et al., 2007, 2008; Aksoy et al., 2008; Armağan & Ünal, 2009; Hamzaoğlu & Budak, 2009; Uysal & Köse, 2009; etc.). *Centaurea wagenitziana* Bancheva & Kit Tan has been recently described from both Bulgaria and Turkey (Kit Tan et al., 2009).

As a consequence of the unnaturalness of such a large genus as *Centaurea* s.l., recent approaches have sorted this taxonomic group into several more natural genera: *Centaurea* s. str., *Cyanus* Mill., *Psephellus* Cass., and *Rhaponticoides* Vaill. (Greuter, 2003; Hellwig, 2004). In the present study we describe a new species, after which the total number of *Centaurea* species known from Turkey rises to 154. This number excludes 57 species, which have been transferred and are now treated within the segregate genera *Psephellus* (33 species), *Cyanus* (16), and *Rhaponticoides* (8).

The new species in *Centaurea* was collected in 2007 and again in 2008, in Karabük Province, in the western Black Sea region of Turkey. Herbarium specimens of the new species and allied taxa are deposited in ISTE and SOM; morphological characters of similar species were also observed in the ISTE, SOM, B, BP, P, W, and WU herbaria. The karyotype of the new species was studied from cells in mitotic metaphase obtained from root tips of three plants collected in the wild from the type locality. Root tips were pretreated with 8-oxychinoline for 30 min., then fixed in acetic alcohol (1:3) for 24 hr. at 4°C, then hydrolyzed in 1 mol/L HCl for 15 min. at 60°C, stained with hematoxylin after Gomori (Melander & Wingstrand, 1953) for 30 min. at 60°C, and then squashed in 45% acetic acid. The karyotype was determined, according to Levan et al. (1964), from eight metaphase plates. The pollen morphology was studied by LM and SEM according to Erdtman's (1960) and Huttunen and Laine's (1983) protocols, respectively. The pollen terminology follows that of Punt et al. (2007).

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Centaurea aytugiana Bancheva, Kaya & Binzet sp. nov. TYPE: Turkey. A4 Karabük: along rd. betw. Bartın & Karabük, 8 km after Ovacuma village, 41°23′537″N, 32°43′303″E, 641 m, 1 Aug. 2007, *S. Bancheva & Z. Kaya 86052* (holotype, ISTE; isotypes, ISTE, SOM-165551). Figures 1, 2.

Ex affinitate *Centaureae stenolepidis* A. Kern., sed ab ea capitulis minoribus angustius cylindricis (5–6 mm vs. 10–15 mm latis), appendicibus phyllariorum pallidioribus brevioribus 6–7 mm (nec 6–12 mm) longis, foliis lyrato-pinnatisectis (nec integris) atque flosculis albidis vel raro roseolis (nec roseopurpureis) differt.

Herbaceous perennial with woody rootstock; stems 22–70 cm, erect, single to numerous, much-branched, sulcate below, puberulent to arachnoid tomentose. All leaves lyrate to pinnatisect, puberulent on both surfaces, puberulent to weakly pilose on veins beneath; outline of leaves in lower third elliptic to narrowly elliptic-ovoid in outline, 13–15 × 2.5–2.8 cm (including petiole), with 4 to 6 pairs of narrowly lanceolate to ovoid or triangular, sometimes decurrently winged segments, 1–4 × 0.5–0.9 cm; middle cauline leaves similar but sessile and smaller, 2–6.5 × 1–3.5 cm, with (3)4 to 7 pairs of lanceolate segments, 0.5–2 × 0.2–0.6 cm, acute at apex; upper leaves entire. Capitula numerous, 20 to 30, 10–20 mm; involucre narrowly ovoid to cylindric, 13–14(–16) × 5–6 mm; phyllaries subcoriaceous, puberulent; middle phyllaries 5–7 × 1.1–2 mm, narrowly lanceolate, pale green, with white to yellowish margins and 3 to 5 light green nerves; appendages partly obscuring the basal part of the phyllaries, 1 mm broad at base, gradually narrowed into threadlike recurved tips, the entire appendage 6–7 mm, stramineous to pale brown basally, with (7)8 to 11 pairs of cilia 2–3 mm long on either side of the appendage. Florets 14–16 mm, white or rarely pale pink; corolla tube ca. 10 mm long, lobes 4–5 mm, linear; filaments 4–5 mm long, puberulent; anther tube of fertile florets whitish, anthers 7–9 × 0.5–1 mm; style 12–14 mm long, style shaft 10–12 mm long, style branches 1.5–2 mm long, hairy at base; marginal florets longer, 18–20 mm, radiate, sterile, with linear laciniae 1/2 as long as tube. Achenes asymmetrically subcylindrical-truncate, 3 × 1.3–1.5 mm, brown and smooth; pappus absent.

Karyology. Based on root tip squashes from mitotic metaphase, the chromosome number of *Centaurea aytugiana* is $2n = 30 + 1B$. The karyotype consists of small chromosomes, about 1.5 μm in size, with the submetacentric chromatid type prevalent. Two pairs of chromosomes with satellites were also evident (Fig. 3A). The basic chromosome number, $x = 15$, is the same as that for most of the species of *Rhaponticoides*. Nevertheless, we consider the new species belongs to *Centaurea* because of the combination of morphological features discussed below.



Figure 1. *Centaurea aytugiana* Bancheva, Kaya & Binzet. —A. Habit. —B. Median phyllary. Scale bars for A and B = 0.5 cm. Drawn by Boris Tzenov from the type collection, *S. Bancheva & Z. Kaya 86052* (SOM-165551).

Pollen. The pollen grains are of Wagenitz's *Jacea*-type (1955), subprolate, with the correlation of the polar axis to the equatorial diameter as 1.18. The exine sculpture is microechinatae, with density of the sculpture elements 3 or 4 to 25 μm² and the height of the microspines ca. 1.5 μm. Equatorial



Figure 2. Capitulum and outer, middle, and inner appendages in *Centaurea* L. A–C. Outer, middle, and inner appendages in *Centaurea*, from left to right. —A. *Centaurea aytugiana* Bancheva, Kaya & Binzet, from isotype *S. Bancheva & Z. Kaya 86052* (SOM-165551). —B. *Centaurea stenolepis* A. Kern., from Bulgaria, Urdina River, near Trun, Aug. 1907, *A. Toshev s.n.* (SOM-85330). —C. *Centaurea salicifolia* M. Bieb. ex Willd., Georgia, Tbilissi, 23 Sep. 1916, *O. Zedelmejer s.n.* (SOM-85494). Distance between horizontal bars at left = 1 mm. —D. Capitulum of *C. aytugiana* from the type collection, *S. Bancheva & Z. Kaya 86052* (SOM-165551.)

diameters averaged 22.5 μm ± 1.5; polar axes averaged 26.3 μm ± 3; length of the colpus averaged 20.1 μm ± 1.4; and breadth of the colpus was 3.3 μm ± 0.6 (Fig. 3B–D).

Distribution and ecology. *Centaurea aytugiana* is known with certainty from only one population in the A4 Karabük Province, growing at an altitude of 641 m, at the edge of shady meadows in xerophilous forests dominated mainly by *Carpinus betulus* L., *C. orientalis* Mill., *Pinus nigra* Arnold, and *P. sylvestris* L. The population comprises ca. 40 individuals distributed in several small groups occupying an area of ca. 1000 m^2. Associates with *Centaurea aytugiana* include *Campanula trachelium* L., *Carlina vulgaris* L., *Centaurea diffusa* Lam., *Centaurea solstitialis* L. subsp. *solstitialis*, *Centaurea stenolepis* A. Kern., *Cichorium intybus* L., *Clematis vitalba* L., *Cornus sanguinea* L., *Digitalis ferruginea* L. subsp. *ferruginea*, *Equisetum telmateia* Ehrh., *Eupatorium cannabinum* L., *Melilotus albus* Medik., *Origanum onites* L., *Prunus avium* (L.) L., *Psoralea bituminosa* L., *Pyracantha coccinea* M. Roem., *Scabiosa columbaria* L. subsp. *columbaria*, and *Sophora jaubertii* Spach ex Jaub. & Spach.

IUCN Red List category. As currently known, *Centaurea aytugiana* is endemic to the western Black Sea region, Turkey, and is considered a Euxinian element, representative from the Euro-Siberian phytogeographic region (Davis, 1971). Specimens were collected in A4 Karabük, where the species is apparently very rare and localized. *Centaurea aytugiana* is currently known only from one population in the type locality and from an area of 1000 m^2. The population is not in good condition and numbered approximately 40 plants in 2007 and 2008. The new species should be regarded as belonging to the Critically Endangered (CR) category (IUCN, 2001), based on its restricted, local distribution and the rather small population size observed.

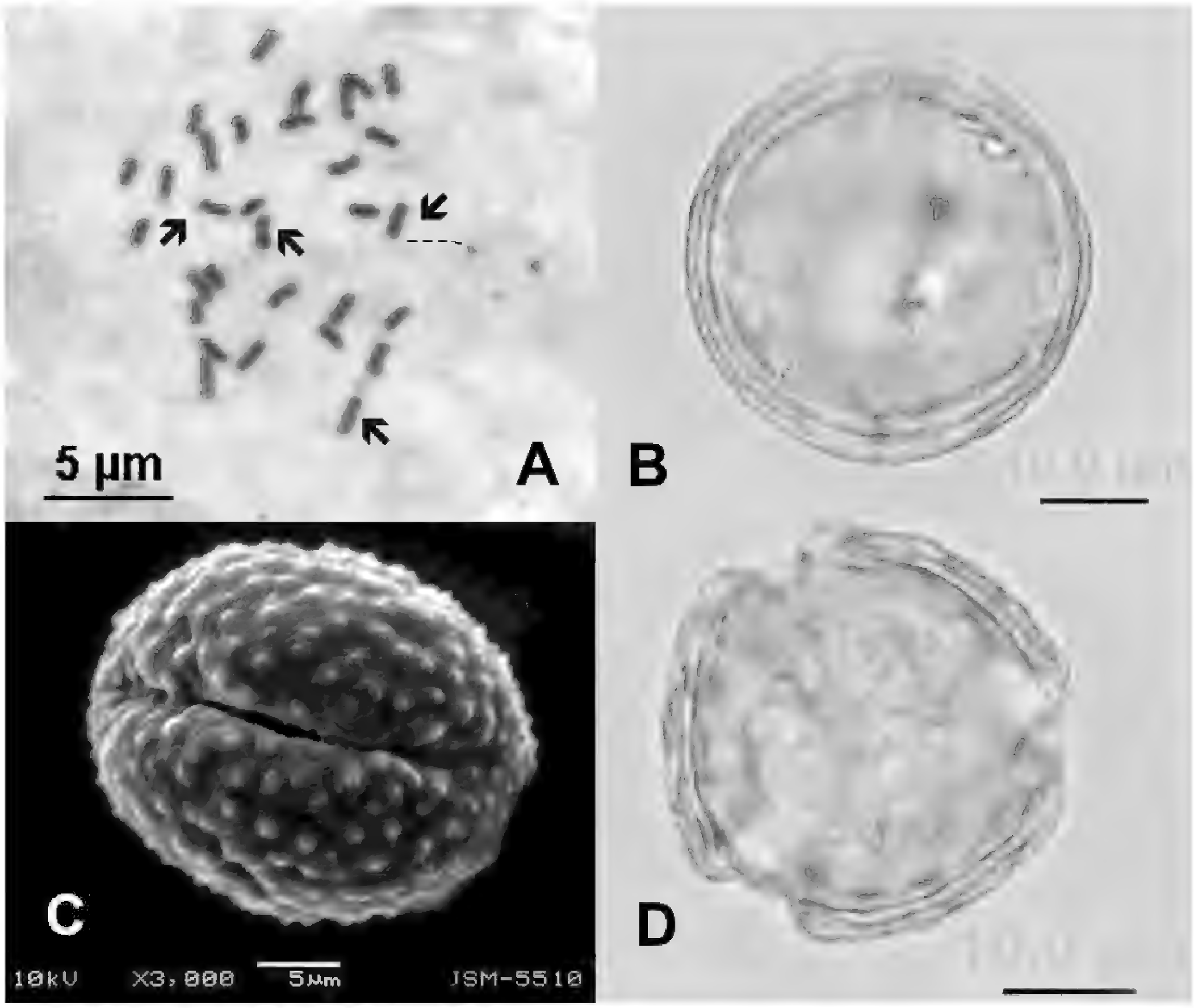


Figure 3. Mitotic metaphase root tip cell and pollen grains of *Centaurea aytugiana* Bancheva, Kaya & Binzet from the type collection, *S. Bancheva & Z. Kaya 86052* (SOM-165551). —A. Mitotic metaphase root tip cell, showing $2n = 30 + 1B$. B–D. Pollen grains. —B. LM photo, equatorial view of pollen. —C. SEM photo of pollen shape and ornamentation. —D. LM photo, polar view of pollen.

Phenology. *Centaurea aytugiana* was observed in flower from mid-July to August, setting fruit until October.

Etymology. We dedicate this new species to Burhan Aytuğ, a well-known Turkish emeritus professor who studied wood anatomy and palynology.

Relationships. The basic chromosome number, $x = 15$, is the same as that for most of the species of *Rhaponticoides*. Nevertheless, we consider the new species belongs to *Centaurea* because of the combination of other morphological features with high taxonomic value. Usually the capitula of *Rhaponticoides* taxa are larger, 12–15 mm wide, versus 5–6 mm wide in the new species (like some representatives of *Centaurea*, subgenera *Jacea* (L.) DC., *Phalolepis* (Cass.) Dobrocz., etc.). *Rhaponticoides* phyllaries (bracts) are entire, with coriaceous margins, and the middle bracts are without an appendage, while in *C. aytugiana* the appendages are 6–7 mm long, partly obscuring the basal part of the phyllaries, gradually narrowed into a threadlike recurved tip, and with (7)8 to 11 pairs of cilia on either side of the appendage. Achenes of *Rhaponticoides* taxa are ca. 8 mm, broadly oblong, with the pappus usually as long as or longer than the achene (Dostál, 1976 as *Centaurea* L. subg. *Centaurea*; Susanna & Garcia-Jacas, 2007), whereas the representatives of some subgenera of *Centaurea* (*Jacea*, *Phalolepis*, etc.) have much smaller, oblong achenes, ca. 2.5–4 mm, and in some cases are without a pappus, as in the new species. In addition the pollen grains of *Rhaponticoides* are of *Centaurium*-type, the most primitive as defined by Wagenitz (1955), while those of *C. aytugiana* are of *Jacea*-type, the most evolutionarily advanced, and typical for genus *Centaurea* s. str. Further molecular studies are

needed to find the exact taxonomic position of the newly described species.

Morphologically the new species resembles *Centaurea stenolepis* and *C. salicifolia* M. Bieb. ex Willd. by the similar shape of the appendage, which is gradually narrowed into a threadlike recurved tip and usually provided with more or less cilia on both sides (Fig. 2A–D). Cilia are more numerous in *C. stenolepis*, with 12 to 18 sparse pairs, and in *C. salicifolia*, with 10 to 15 pairs crowded toward the base, but fewer in *C. aytugiana*, with eight to 11 sparse pairs. Appendages are darker in similar species: brown to light brown apically in *C. stenolepis* and brown to blackish brown in *C. salicifolia* versus a lighter stramineous color in the new species. Appendages are the longest in *C. stenolepis*, 6–12 mm; of medium length, 6–7 mm, in the new species; and the shortest in *C. salicifolia*, 3–5 mm. The involucre is narrower in *C. aytugiana*, 5–6 mm, versus 10–15 mm in *C. stenolepis* and 8–10(12) mm in *C. salicifolia*. Leaves are lyrate to pinnatisect in the new species, but are entire (minutely denticulate) and broadly lanceolate to lanceolate in *C. stenolepis* and entire or denticulate (rarely dentate) and lanceolate in *C. salicifolia*. Florets are usually white in *C. aytugiana*, but a darker rose-purple in both *C. stenolepis* and *C. salicifolia*. The chromosome number of $2n = 30 + 1B$ reported here for *C. aytugiana* does not coincide with the chromosome numbers of *Centaurea* sect. *Lepteranthus* (DC.) Dumort. and *Centaurea* sect. *Jacea* (L.) DC., where *C. stenolepis* and *C. salicifolia* respectively assign (Wagenitz, 1975; Dostál, 1976). Two chromosome reports ($2n = 22$ and $2n = 44$) are known for *C. stenolepis* (Kuzmanov & Georgieva, 1977; Lovric, 1982; Sharkova, 1996; Dobeš et al., 1997; Bancheva, 1998), and only one report for *C. salicifolia* ($2n = 22$) (Tonian, 1980).

Pollen morphology together with base chromosome number and DNA sequences are the most important data used in a taxonomy of *Centaurea* s.l. and subtribe Centaureinae Dumort. (Wagenitz & Hellwig, 1996; Hellwig, 2004). Wagenitz (1955) delimited eight *Centaurea* pollen types corresponding very well to the main taxonomic clusters into the group. The pollen grains of *C. aytugiana* belong to Wagenitz's *Jacea*-type, typical for sections *Jacea*, *Lepteranthus*, and *Acrolophus* (Cass.) DC. and characterized by a reduction of the spines and inner layer of columellae, thus apparently standing at the end of an evolutionary line (Wagenitz, 1955). *Centaurea stenolepis* has the same pollen type (Bancheva, 1999), whereas *C. salicifolia* has not been investigated.

Based on some morphological features (e.g., the shape of appendages, the shape and size of achenes, the pollen type), *Centaurea aytugiana* might be provisionally placed in subgenus *Jacea* (section *Lepteranthus*), but further molecular investigations for determination of its exact taxonomic position are necessary and will be provided.

Karyological voucher. Turkey, A4 Karabük: along rd. betw. Bartın & Karabük, 8 km after Ovacuma village, 41°23′537″N, 32°43′303″E; 641 m, 1 Aug. 2007, *S. Bancheva & Z. Kaya* (ISTE).

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Three New Combinations and a Replacement Name in Eurasian *Senecio* (Compositae, Senecioneae)

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ABSTRACT. Three new combinations (Compositae, Senecioneae), *Senecio doronicum* (L.) L. subsp. *longifolius* (Willk.) J. Calvo, *S. macedonicus* Griseb subsp. *barckhausiifolius* (Boiss. & Heldr.) J. Calvo, and *S. racemosus* (M. Bieb.) DC. subsp. *kirghisicus* (DC.) J. Calvo, are here proposed, as well as the replacement name *S. doronicum* subsp. *orientalis* J. Calvo for *S. orientalis* Ten. The names *S. doronicum* var. *longifolius* Willk., *S. orientalis* Ten., *S. barckhausiifolius* Boiss. & Heldr., and *Cineraria glabrata* Ledeb. are lectotypified.

Key words: Asteraceae, Compositae, Eurasia, *Senecio*, Senecioneae.

Senecio L. sect. *Crociseris* (Rchb.) Boiss. is currently the focus of an exhaustive taxonomic revision based on ca. 5500 herbarium specimens from 48 herbaria. The monograph being prepared comprises 28 species and eight subspecies distributed from western Europe and northwestern Africa to central Asia. As a result of this study, a few nomenclatural adjustments are needed, and thus the following new combinations are here established.

Senecio doronicum (L.) L. is a perennial herbaceous plant characterized by bearing one to four (up to nine) capitula, with supplementary bracts usually as long as the principal ones, and leaves with glabrescent to arachnoid indumentum. The species is widely distributed through the southern European mountain ranges, from the Cantabrian Range to the northern Dinaric Alps. As frequently occurs in species with a wide distribution, intraspecific variability is expectedly high, mainly in number of capitula, indumentum of the involucre, number of supplementary bracts, and also in the shape and indumentum of the leaves. Such variability follows geographical patterns, and in most cases these populations can be easily distinguished morphologically. Therefore, in the taxonomic treatment of *Senecio* sect. *Crociseris* (Calvo, Álvarez, and Aedo, in prep.) three subspecies are recognized. The typical variety, *S. doronicum* subsp. *doronicum*, comprises populations from the Alps and corresponds to what is traditionally ascribed as *S. doronicum*. This taxon is characterized by bearing (one to) two to four (up to seven) capitula, (nine to) 14 to 22 (up to 26) supplementary bracts with weakly arachnoid to floccose indumentum, and the leaves are covered with scattered arachnoid trichomes above, and arachnoid to floccose trichomes beneath. Two other subspecies of *S. doronicum* are here established, and their basionyms lectotypified.

1. Senecio doronicum (L.) L., Syst. Nat. (ed. 10) 2: 1215. 1759. Basionym: *Solidago doronicum* L., Sp. Pl. 2: 880. 1753, nom. cons. TYPE: France. Haute-Savoie, Bonneville, Brezon, près de la Glacière, [46°02′N, 6°25′E], July 1848, *E. Bourgeau 129* (typ. cons., designated by Calvo et al. [2011a: 1215] and Calvo [2012: 1133], P-3777644 [digital image]; isolectotypes, BM-810151 [digital image], G-308097 [digital image], K, LE, MPU-19494 [digital image], P-3777665 [digital image], P-3777666 [digital image], P-3777667 [digital image]).

1a. Senecio doronicum (L.) L. subsp. **doronicum.**

1b. Senecio doronicum subsp. **longifolius** (Willk.) J. Calvo, comb. et stat. nov. Basionym: *Senecio doronicum* var. *longifolius* Willk., as "*longifolia*," Oesterr. Bot. Z. 41: 4. 1891. TYPE: Spain. Catalonia: Vall d'Aran, lago de Toro (Viella), [42°38′N, 0°43′E], July 1873, *M. Compañó s.n.* (lectotype, designated here, COI-37582).

Senecio doronicum subsp. *longifolius* includes those populations from the Cantabrian Range, Pyrenees, and the Central Massif that are characterized by displaying one (up to three) capitulum, (seven to) 10 to 15 (up to 18) supplementary bracts with scattered arachnoid trichomes on the margin, and leaves glabrescent above with scattered scabrid or arachnoid trichomes beneath.

We found only a Compañó collection from the Willkomm Herbarium at COI identified in his own handwriting as "Senecio doronicum var. longifolia

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Wk. ined." The specimen was collected at Lago de Toro (Viella), and it matches perfectly with the description provided in the protologue. However, the label shows the date "July 1873," whereas the protologue states "August 1878." Since Willkomm himself annotated the abbreviation "ined." (from the Latin *ineditus*) after the determination, we consider specimen COI-37582 original material and therefore suitable for lectotypification. The inconsistency of the dates could be attributed to a misprint of the publication.

Selected specimens examined. ANDORRA. Ordino, port de Siguer, estanyons de Banyell, 42°38′N, 1°34′E, 30 Aug. 2002, *C. Aedo, I. Aizpuru & J. Pedrol 8630* (MA). FRANCE. **Ain:** Jurassus mons, Le Reculet, 46°15′N, 5°55′E, 18 July 1886, *H. A. Romieux s.n.* (H). **Cantal:** près au sud-est de Malbo, 44°58′N, 2°45′E, 26 June 1884, *J. de Puyfol 1714* (MT, WU). **Tarn:** Mazamet, pic de Nore, 43°26′N, 2°28′E, 28 June 2011, *J. Calvo 5658* (MA). SPAIN. **Asturias:** Lena, Tuiza de Arriba, peña Ubiña, ladera este, 43°1′N, 5°56′W, 25 July 2009, *J. Calvo 4020* (MA). **Huesca:** Sahún, macizo del Posets, refugio de Angel Orús, 42°36′N, 0°26′E, 20 Aug. 1987, *M. Luceño et al. 141* (MA). **Lleida:** Pallars, pr. Espot, 42°34′N, 1°4′E, 9 July 1977, *F. J. Fernández Casas et al. 2022* (MA). SWITZERLAND. **Vaud:** Jura, Massif du Jura, La Dole, 46°25′N, 6°5′E, 17 Aug. 2010, *J. Calvo 4982* (MA).

1c. Senecio doronicum subsp. **orientalis** J. Calvo, replacement name. Replaced name: *Senecio orientalis* Ten., Fl. Napol. 2: 222. 1820, nom. illeg., non *Senecio orientalis* Mill., Gard. Dict. (ed. 8), n. 10. 1768, nec *Senecio orientalis* Willd., Sp. Pl. (ed. 4) [Willdenow] 3(3): 2006. 1803, nom. illeg. TYPE: Italy. Lazio: Rieti, Accumoli, M. di Accumoli, [42°43′N, 13°11′E], s.d., *A. Orsini s.n.* (lectotype, designated here, NAP [digital image]).

Senecio doronicum subsp. *orientalis* includes the populations from the eastern Alps to the northern Dinaric Alps and the central Apennines. This taxon is characterized by bearing (one to) two to four (up to nine) capitula, (nine to) 14 to 18 (up to 24) supplementary bracts with scattered arachnoid trichomes, and leaves glabrescent on both faces, rarely with scattered scabrid-arachnoid trichomes beneath.

Although *Senecio orientalis* Ten. is an illegitimate name because it is a later homonym (ICN Art. 53.1 [McNeill et al., 2012]), we re-use the final epithet in a different name under ICN Art. 58.1 (McNeill et al., 2012). The resulting name is treated as a replacement name with the same type of *S. orientalis* Ten., which is lectotypified herein.

According to Stafleu and Cowan (1986), the main set of Tenore's collection is kept at NAP. The curator of this herbarium kindly replied to our request to examine this material, and there appear to be several syntypic collections represented among this material. The best-preserved specimen, most closely matching the protologue, is an Orsini collection from Monti di Accumoli, an area currently included in the Lazio region but that used to belong to the Abruzzi region during the Kingdom of the Two Sicilies. In the protologue of *Senecio orientalis*, Tenore (1820: 223) cited "Luogo natale, ec. Nasce sui monti di Principato Ulteriore e degli Abruzzi, a Bagnoli, alla Maiella." Therefore the Orsini specimen clearly corresponds to the original geographic distribution of the several specimens as seen by Tenore. It is also interesting to note that the first identification of this specimen, by Orsini, was *S. doronicum*, and subsequently Tenore erased it and added "orientalis" and "Orsini."

Selected specimens examined. AUSTRIA. **Carinthia:** Kärnten, Gurktaler Alpen, Ebene Reichenau, 46°53′N, 13°56′E, 16 Sep. 1978, *M. A. Fischer s.n.* (WU). **Tyrol:** Osttirol, Venedigergruppe, am Naturlehrpfad I von Bichl über Katin zur Sajat Hütte, 47°2′N, 12°21′E, 29 July 1985, *E. Albertshofer s.n.* (M). BOSNIA-HERZEGOVINA. Dalmatien, Dinarische Alpen, Südostabhänge der Dinara, 43°59′N, 16°22′E, 8 July 1907, *E. Janchen & B. Watzl s.n.* (WU). CROATIA. Berg Klek bei Ogulin, über Musulinski-Potok, 45°15′N, 15°8′E, 15 July 1890, *R. Beyer s.n.* (B). GERMANY. **Bavaria:** Alpes calcaires près de Berchtesgaden, 47°33′N, 12°56′E, 1 Sep. 1850, *A. Einsele 877* (L). ITALY. **Abruzzo:** Montis Cavallo, Majella, 42°7′N, 14°6′E, Aug. 1875, *H. Groves s.n.* (K). **Lazio:** Rieti, NE Monte Terminillo, 42°28′N, 13°0′E, 4 Aug. 1973, *H. Merxmüller & J. Grau 20731* (M). **Veneto:** Monte Serva, 46°12′N, 12°13′E, 4 July 1871, *G. C. Spreitzenhofer s.n.* (B). SLOVENIA. Nanos-vuori, 45°47′N, 14°3′E, 4 July 1985, *V. Kolari 2342* (H).

2. Senecio macedonicus Griseb., Spic. Fl. Rumel. 2(5/6): 221. 1846. TYPE: Greece. Macedonia, s.d., *E. Frivaldszky s.n.* (lectotype, designated by Strid [2000: 274], G-150321 [digital image]; isolectotypes, GOET-2380 [digital image], K, LE, MO-5578157, WU).

2a. Senecio macedonicus Griseb. subsp. **macedonicus.**

2b. Senecio macedonicus Griseb. subsp. **barckhausiifolius** (Boiss. & Heldr.) J. Calvo, comb. et stat. nov. Basionym: *Senecio barckhausiifolius* Boiss. & Heldr., as "barckhausiaefolius," Diagn. Pl. Orient. ser. 2, 6: 101. 1859. TYPE: Greece. Attica Periphery, Sterea Ellas, Patéras Óros, m. Patéras Atticae, [38°07′N, 23°18′E], 27 May 1856, *J. Guicciardi 3197* (lectotype, designated here, G-150319 [digital image]).

Senecio macedonicus is a robust plant from Bulgaria (Stojanov & Stefanoff, 1948) and Greece

characterized by bearing ovate to lanceolate synflorescence bracts, similar to the upper leaves, and having supplementary bracts of the involucre lanceolate to linear-oblong, sometimes with scarious margin. It is a variable species mostly with regard to the abundance of indumentum and leaf shape. We therefore recognize two subspecies within this taxon, *S. macedonicus* subsp. *macedonicus* and *S. macedonicus* subsp. *barckhausiifolius*. The latter differs by having irregularly pinnatipartite leaves, instead of the entire, crenate, or slightly dentate leaves characteristic of the typical subspecies. In fact, the subspecific epithet *barckhausiifolius* probably refers to the pinnatifid leaves found in several species of the genus *Barckhausia* DC. It is also worthwhile to mention that the same taxon was described by Halácsy in the varietal rank as *S. macedonicus* var. *pinnatilobatus* (Halácsy, 1904). Since in the subspecific rank no name is available, we consider it appropriate to retrieve the Boissier/Heldreich epithet, described in 1859.

Senecio macedonicus subsp. *barckhausiifolius* is only known from a few localities in Attica and Peloponnese, in Greece.

Selected specimens examined. GREECE. **Attica:** ad radices mt. Parnethis pr. Limico, 38°9′N, 23°49′E, 25 May 1909, *B. Tuntas 124* (B, FI); Limiko prope Salesi, 38°14′N, 23°41′E, 4 May 1908, *B. Tuntas 283* (WU). **Peloponnese:** Laconia, mt. Taygetus pr. Anavryti, 37°06′N 22°17′E, 1 June 1902, *C. Leonis 123* (B, G, G-DC, JE, M, WU).

3. Senecio racemosus (M. Bieb.) DC., Prodr. [A. P. de Candolle] 6: 358. 1838. Basionym: *Cineraria racemosa* M. Bieb., Tabl. Prov. Mer Casp. 2: 119. 1798. TYPE: Azerbaijan. Xizi, Altiaghach, ex montibus Schirvanicis, [40°52′N, 48°58′E], 1796, *F. A. M. Bieberstein s.n.* (lectotype, designated by Menitsky & Konechnaya [2001: 95], LE).

3a. Senecio racemosus subsp. **racemosus.**

3b. Senecio racemosus subsp. **kirghisicus** (DC.) J. Calvo, comb. et stat. nov. *Cineraria glabrata* Ledeb., Icon. Pl.: 22, tab. 94. 1829, nom. illeg., replaced name, non *Cineraria glabrata* Sw., Fl. Ind. Occid. 3: 1354–1355. 1806 [ICN, Art. 53.1]. *Senecio kirghisicus* DC., Prodr. 6: 362. 1838, as "Kirghisicus," replacement name, non *Senecio glabratus* Hook. & Arn., Bot. Beechey Voy. 1: 32. 1830. TYPE: Kazakhstan, Altai [Kara-su stream, viz. ind. loc., 49°41′N, 74°58′E], s.d., *C. F. Ledebour s.n.* (lectotype, here designated, LE).

Senecio racemosus (M. Bieb.) DC. subsp. *kirghisicus* (DC.) J. Calvo [≡ *S. kirghisicus* DC.] is a taxon known from Ukraine, European Russia, southwestern Siberia, and Kazakhstan. It is a herbaceous perennial characterized by bearing a racemose or narrowly paniculate synflorescence, having semiamplexicaule cauline leaves, and the stem base covered with brown fibrous remnants of dead leaves. On the basis of our taxonomic study, we realize that only the achene indumentum is useful to discriminate subspecies *kirghisicus* from the typical *S. racemosus*, which is distributed along eastern Anatolia, northern Iraq, western Iran, and the Caucasus region. *Senecio racemosus* subsp. *kirghisicus* has unicellular trichomes along the length of the achene ribs, while in *S. racemosus* subsp. *racemosus* the achenes are glabrescent or covered with trichomes in the upper part only.

The obvious morphological similarity between *Senecio racemosus* and *S. kirghisicus* (i.e., the basionym of this new combination) led Ledebour (1845: 643) to synonymize the latter taxon under the name *S. racemosus*. Moreover, it can be noted that the collections belonging to this taxon were identified under the name *S. racemosus* until Schischkin (1961: 733) retrieved the name *S. paucifolius* S. G. Gmel., which again confirms the closest relation between them. The name *S. paucifolius* was later proposed to be conserved with a conserved type (Calvo et al., 2011b) because the only original material is a plate that does not correspond to the current concept of the species. Nevertheless the conservation was not recommended (Applequist, 2012), and consequently *S. kirghisicus* becomes the priority name.

Taking into account that the ranges of *Senecio racemosus* and *S. kirghisicus* are notably well delimited and that in most cases it is possible to distinguish them from each other, we consider it appropriate to subordinate each of them as subspecies. Since the basionym of *S. racemosus* was published earlier, the combination *S. racemosus* subsp. *kirghisicus* is needed.

In the protologue of *Senecio kirghisicus*, de Candolle (1838: 362) included the synonym *Cineraria glabrata* toward the end of the species description. The indicated locality was "rivulum Kara-tsu deserti Kirghisorum," which corresponds to what Ledebour cited (1829: 22, tab. 94) in the protologue of *C. glabrata*. The de Candolle description added only the number of ligulate flowers, probably based on observation of Ledebour's plate. In fact, the lack of any indication of specimens or other collections at the end of the protologue of *S. kirghisicus* suggests that de Candolle studied neither

fresh nor dry material. Therefore, it seems evident that de Candolle was only transferring *C. glabrata* to the genus *Senecio*. It is inferred that de Candolle knew of the existence of *S. glabratus* Hook. & Arn. (1830: 32) because he chose the different epithet *kirghisicus*, referring to the distribution indicated by Ledebour and therefore establishing a replacement name for *C. glabrata*. De Candolle did not include in his transfer the name *C. auriculata*, a name that Ledebour published in 1833 to replace his illegitimate *C. glabrata*, which was previously used by Swartz in 1806. Given that Burman had used the name *S. auriculatus* for a plant from Java in 1768 ([= *Emilia sonchifolia* (L.) DC. var. *javanica* (Burm. f.) Mattf.], according to J. Pruski (2012, pers. comm.), the use of this epithet is blocked in *Senecio*.

The plate included in the original description of *Cineraria glabrata* (Ledebour, 1829) is completely explanatory and includes detailed drawings. However, we have also located an original collection by Ledebour kept at LE. The sheet contains two synflorescences and several basal leaves, and it is labeled in Ledebour's handwriting (Lipschitz & Vassilczenko, 1968) with "Solidago glabrata, Prodr. fl. alt.," which corresponds to his protologue. It is interesting to note that subsequently he erased the word "*Solidago*" and added "*Cineraria*" to the sheet. The locality and date are lacking, but Ledebour's first identification proves that it was collected before the publication of *C. glabrata*. Therefore, the aforementioned sheet is here designated as the lectotype for *Senecio kirghisicus* and, therefore, for the infraspecific taxon *S. racemosus* subsp. *kirghisicus*.

Selected specimens examined. KAZAKHSTAN. **Karagandy:** inter mont Karkaraly et Bajanaul, 50°12′N, 75°26′E, July 1843, *A. G. Schrenk 136* (LE, UPS). RUSSIA. **Bashkortostan:** Ufa, Chishmy station, 54°34′N, 55°22′E, 18 July 1915, *I. V. Novopokrovskiy & V. N. Yakovlev 1240* (LE, S). **Orenburg:** Kvarkenskiy rayon, in Sukhaya Kamenka ravine, 52°12′N, 59°18′E, 24 July 1930, *K. S. Afanasiev 476* (LE). **Voronezh:** 20 km to SW Novokhopersk village, near Tykhovo village, 51°1′N, 41°30′E, 14 Aug. 1970, *S. S. Ikonnikov & N. P. Litvinova 4128* (LE). UKRAINE. **Dnipropetrovsk:** Ekaterinoslav governorate, Pavlograd uyezd, Nikolaev khutor, near Ternovoe village, 48°30′N, 36°5′E, July 1894, *F. N. Alexeenko s.n.* (LE). **Mykolaiv:** Podolia australis, pr. Olviopol, 48°2′N, 30°51′E, 14 Aug. 1882, *Scharolhowa s.n.* (LE). **Poltava:** Poltawa, 49°36′N, 34°35′E, *A. S. Rogowicz s.n.* (G, LE).

Acknowledgments. We thank the curators of the herbaria mentioned in the text for their valuable help with the location of *Senecio* collections and specimen loans. We are very grateful to Jorge Paiva and Annalisa Santangelo for kindly sending photographs of the potential type material. And special thanks go to Félix Muñoz Garmendia and John Pruski for their advice. This work was financed by Flora Iberica project CGL2011-28613-C03-01 and by a Ph.D. grant to J. C. (JAE-Pre, Consejo Superior de Investigaciones Científicas/CSIC).

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Pendulorchis gaoligongense var. *lushuiensis* (Orchidaceae, Vandeae), a New Variety from Yunnan, China

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ABSTRACT. *Pendulorchis gaoligongense* G. Q. Zhang, K. Wei Liu & Z. J. Liu var. *lushuiensis* L. J. Chen, X. C. Shi & W. H. Rao (Orchidaceae, Vandeae) is described and illustrated as a new variety from Yunnan, China. It differs from the typical variety, *P. gaoligongense*, by having shorter leaves that are 30–40 cm, smaller flowers that are 4–5 mm diameter, and a reddish white perianth (vs. leaves 40–60 cm, flowers 8–9 mm diameter, and a purple-red perianth).

Key words: China, IUCN Red List, Orchidaceae, *Pendulorchis*, Vandeae, Yunnan.

Pendulorchis Z. J. Liu, K. Wei Liu & G. Q. Zhang (Orchidaceae, Vandeae) is comprised of two species that range from Myanmar (Burma) to southwestern China and northeastern India to Bhutan and into China (Zhang et al., 2013). The new plant taxon treated here was collected in Lushui County during a botanical trip to southwestern Yunnan, China, in autumn 2010. Many small, pendent plants, some of which were in full bloom, were observed as epiphytes on the branches and trunks of tall trees on the edge of evergreen forest on slopes. It is very similar in habit and flower appearance to *P. gaoligongense* G. Q. Zhang, K. Wei Liu & Z. J. Liu, a species distributed in the Gaoligong Mountains of southwestern China (Zhang et al., 2013). Several plants of the latter species have been cultivated in the nursery of the National Orchid Conservation Center of China (NOCC) in Shenzhen and produce flowers every year in early November. A comparison of living plants between *P. gaoligongense* and the entity brought back from Lushui County indicates that there are differences between the taxa, both in vegetative and floral features. As a result, the Lushui plants are described here as a new variety.

1. Pendulorchis gaoligongense G. Q. Zhang, K. Wei Liu & Z. J. Liu in Zhang et al., PLoS ONE 8(4): e60097. [5 Apr.] 2013. TYPE: China. Yunnan: Gaoligongshan, Lushui, 2010 m, 10 Oct. 2011, *Z. J. Liu 5871* (holotype, NOCC).

1a. Pendulorchis gaoligongense var. **gaoligongense.**

1b. Pendulorchis gaoligongense var. **lushuiensis** L. J. Chen, X. C. Shi & W. H. Rao, var. nov. TYPE: China, Yunnan: Pianma, Lushui, ca. 1960 m, growing on branch of a big tree (*Cupressus funebris* Endl., Cupressaceae) on edge of evergreen forest, 4 Oct. 2010, *L. J. Chen 5082* (holotype, NOCC). Figures 1, 2.

Haec varietas a *Pendulorchide gaoligongensi* G. Q. Zhang, K. Wei Liu & Z. J. Liu var. *gaoligongensi* foliis 30–40 cm longis, inflorescentiis 3 ad 15, floribus 4–5 mm in diametro atque perianthio rubello-albo differt.

Epiphytic plants, pendent, with many long and flattened roots; stems 13–24 cm, 4–5 mm diam., often branched, enclosed by leaf sheaths. Leaves 6 to 14, fleshy, deep green, subterete, 30–40 cm, 3–5 mm diam., channeled adaxially, apex acute, at base jointed and sheathing; sheaths 3–4.5 cm. Inflorescences 3 to 15, paniculate or racemose, arising from axils of lower leaves, 7–12 cm, with 17 to 39 flowers; floral bracts broadly ovate, 2–2.5 mm, apex obtuse. Flowers 4–5 mm diam., perianth inflexed forward, reddish white; pedicel and ovary 1–1.4 cm; sepals

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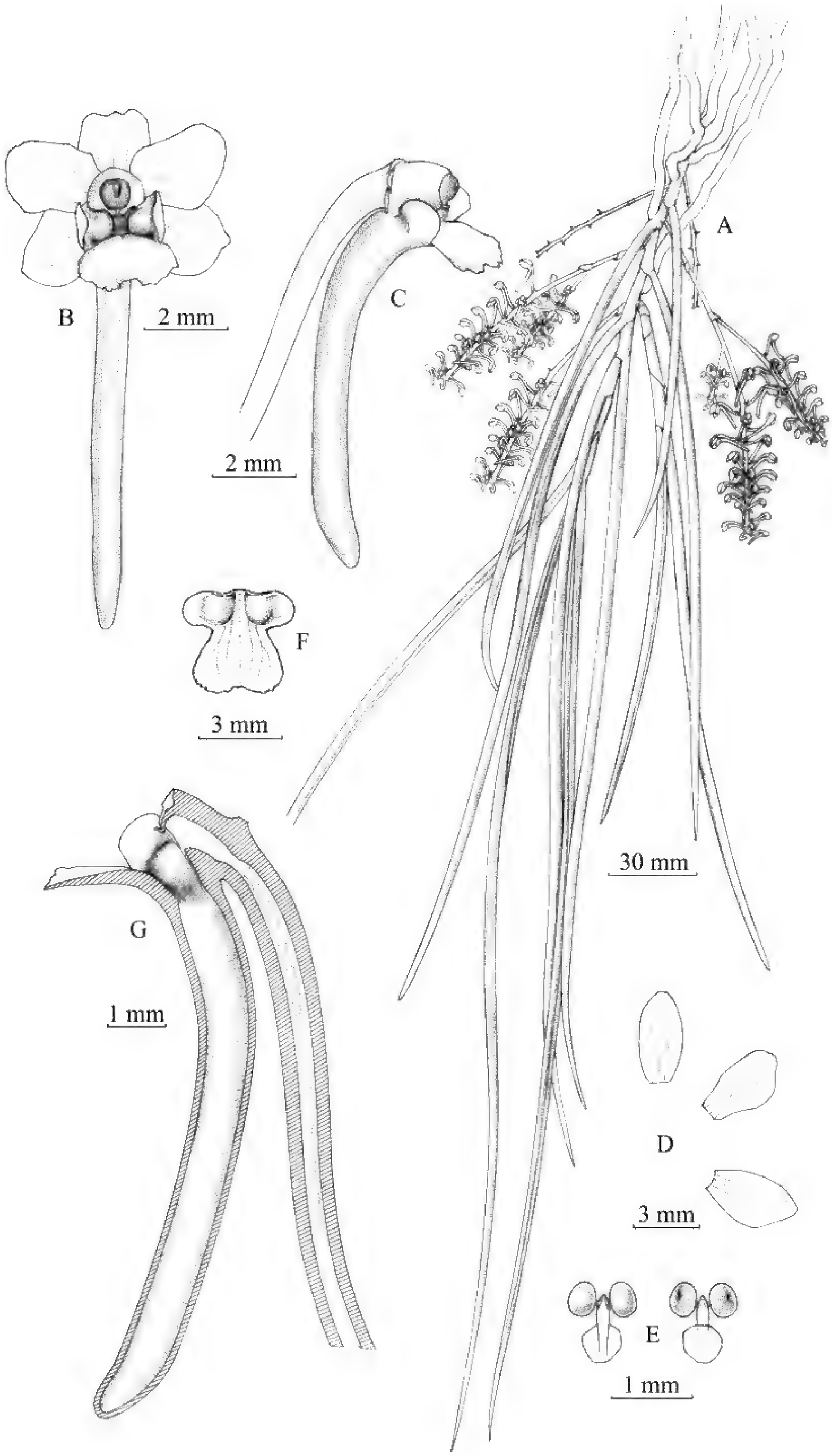


Figure 1. *Pendulorchis gaoligongense* G. Q. Zhang, K. Wei Liu & Z. J. Liu var. *lushuiensis* L. J. Chen, X. C. Shi & W. H. Rao. —A. Flowering plant. —B. Flower, front view. —C. Column and lip, side view. —D. From top to bottom: dorsal sepal, petal, and lateral sepal. —E. Pollinarium, front view and back views. —F. Lip. —G. Column and lip, longitudinal section. Drawn by X. Y. Ma from the type *L. J. Chen 5082* (NOCC).

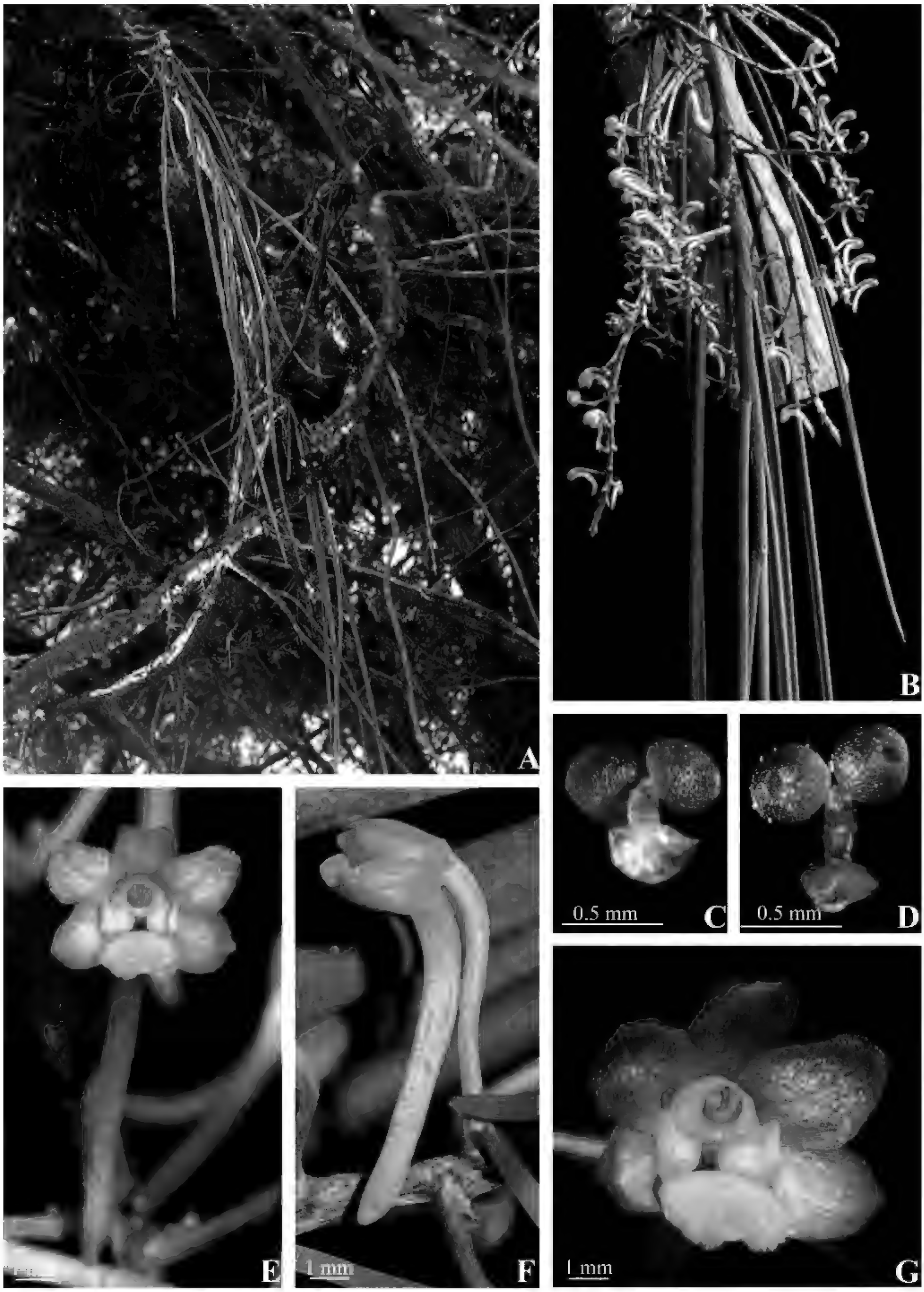


Figure 2. Photographs of *Pendulorchis gaoligongense* G. Q. Zhang, K. Wei Liu & Z. J. Liu var. *lushuiensis* L. J. Chen, X. C. Shi & W. H. Rao at the type locality in Lushui County, Yunnan, and of *P. gaoligongense*, cultivated at NOCC. —A. Plants epiphytic on tree trunk. —B. Inflorescences on fertile plant. —C. Pollinarium, front view. —D. Pollinarium, back view. —E. Flower, front view. —F. Flower, side view. —G. Flower of *P. gaoligongense*, front view, from a plant cultivated at NOCC (*Z. J. Liu 5871*). Photo by L. J. Chen.

reddish white, dorsal sepal oblong, 4–4.6 × 1.8–2.1 mm, apex rounded to obtuse, abaxially carinate, lateral sepal elliptic, 4–4.6 × 2.5–2.8 mm, apex obtuse; petals reddish, obovate to elliptic, 4–4.5 × 2.1–2.3 mm, apex obtuse; lip reddish and concolorous with sepals and petals, 3-lobed; side-lobe erect, oblong, 2–2.5 × 1–1.2 mm, obtuse, toward abaxial base strongly concave forming a callus-like structure, mid-lobe spreading forward, obovate, 2.5–3 × 2.5–3 mm, adaxially with 3 longitudinal midveins, apex subtruncate and slightly emarginate; spur cylindric, 1–1.4 cm, 1.3–1.6 mm thick, slightly curved upward, obtuse-tipped; column stout and short, 1.8–2 mm; operculum deep purple; pollinia 2, reddish white, globose, cleft, attached by a common stipe to a large suborbicular viscidium.

Distribution and habitat. The new species was discovered in Lushui County in southwestern Yunnan, China. This epiphytic orchid grows on the branches and trunks of tall trees on the edge of evergreen forest at an altitude of ca. 1960 m.

IUCN Red List category. *Pendulorchis gaoligongense* var. *lushuiensis* is known only from the type locality, where only 13 small clumps were seen during our two-day stay. Each of these consisted of no more than 30 individuals. We failed to see more plants in the vicinity of the type locality at Lushui County, and the location is threatened by human activity. Therefore, this species in classified as Vulnerable (VU), according to IUCN Red List categories and criteria (IUCN, 2001).

Phenology. *Pendulorchis gaoligongense* var. *lushuiensis* was observed in flower from October to November in the wild.

Taxonomic relationships. *Pendulorchis gaoligongense* var. *lushuiensis* differs from the typical variety, *P. gaoligongense*, by having shorter leaves that are 30–40 cm, smaller flowers of 4–5 mm diameter, and a reddish white perianth (vs. leaves 40–60 cm, flowers 8–9 mm diameter, and a purple-red perianth).

Paratype. CHINA. **Yunnan:** Lushui Co., Pianma, 4 Oct. 2010, *L. J. Chen 5083* (CANT).

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Andryala perezii (Asteraceae), a New Species from the Canary Islands

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Abstract. *Andryala perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq. (Asteraceae), a new species from the Canary Islands, is described and illustrated. Although formerly included in *A. glandulosa* Lam., the new species differs remarkably from Madeiran populations by its woolly stellate pubescence, scattered glandular pubescence restricted to the peduncles and involucral bracts, peduncles flattened and enlarged at the base of the capitula, and smaller cypselae. *Andryala perezii* has a habit similar to that of the Canarian *A. pinnatifida* Aiton but may be identified by its densely stellate pubescence on the stems; grayish white or glaucous, congested leaves with dense stellate pubescence on both surfaces and undulate-crispate margins; longer peduncles; and smaller cypselae with a ring of short teeth at the apex equivalent to the height of the prolongation of the ribs. Comments on the chromosome numbers, geographic distribution, habitat, and conservation status are also presented. The name *A. pinnatifida* Aiton f. *cuneifolia* Sch. Bip. is lectotypified and is transferred in rank as *A. pinnatifida* subsp. *cuneifolia* (Sch. Bip.) M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq.; lectotypes are designated for its synonyms, *A. pinnatifida* f. *buchiana* Sch. Bip. and *A. pinnatifida* var. *latifolia* Bornm. The name *A. pinnatifida* is also lectotypified. A key for Macaronesian *Andryala* L. taxa is provided.

Key words: *Andryala*, Asteraceae, IUCN Red List, Madeira, Spain.

Based on present taxonomic concepts, the genus *Andryala* L. comprises 13 species that are distributed across the Mediterranean Basin, being also present in Macaronesia and Romania (Greuter, 2006+). In Macaronesia, *Andryala* is represented by *A. integrifolia* L. and *A. laxiflora* DC. and at least eight endemic taxa distributed in the Canary and Madeira archipelagos (Jardim & Menezes de Sequeira, 2008; Acebes Ginovés et al., 2010). The Madeira Archipelago hosts *A. integrifolia* (recently introduced), *A. crithmifolia* Aiton (a rare endemic), and *A. glandulosa* Lam. (Press, 1994; Ferreira et al., 2011), the latter including *A. glandulosa* subsp. *glandulosa* and *A. glandulosa* subsp. *cheiranthifolia* (L'Hér.) Greuter. For the Canary Islands, Acebes Ginovés et al. (2010) recognized *A. integrifolia* (as probably native), *A. laxiflora* (as introduced), and two endemic species: *A. webbii* (Sch. Bip. ex Christ) A. Santos and *A. pinnatifida* Aiton, the latter including four subspecies: *A. pinnatifida* subsp. *pinnatifida*, *A. pinnatifida* subsp. *preauxiana* (Sch. Bip.) G. Kunkel, *A. pinnatifida* subsp. *buchiana* (Sch. Bip.) Reyes-Bet. & A. Santos, and *A. pinnatifida* subsp. *teydensis* (Sch. Bip.) Rivas-Mart., Wildpret, del Arco, O. Rodr., Pérez de Pérez, Garciá Gallo, Acebes, T. E. Díaz & Fern.-Gonz.

The *Andryala* populations on the eastern Canary Islands (Lanzarote and Fuerteventura) were originally included by Schultz Bipontinus (1849), together with populations from Tenerife, as the form *A. pinnatifida* f. *buchiana* Sch. Bip. of the polymorphic *A. pinnatifida* from the Canary Islands. Later Lid and Lid (1967) and Kunkel (1977, 1978, 1980) placed these populations in the Madeiran *A. glandulosa* (including *A. cheiranthifolia* L'Hér.), as did Hansen and Sunding (1993) and Acebes Ginovés et al.

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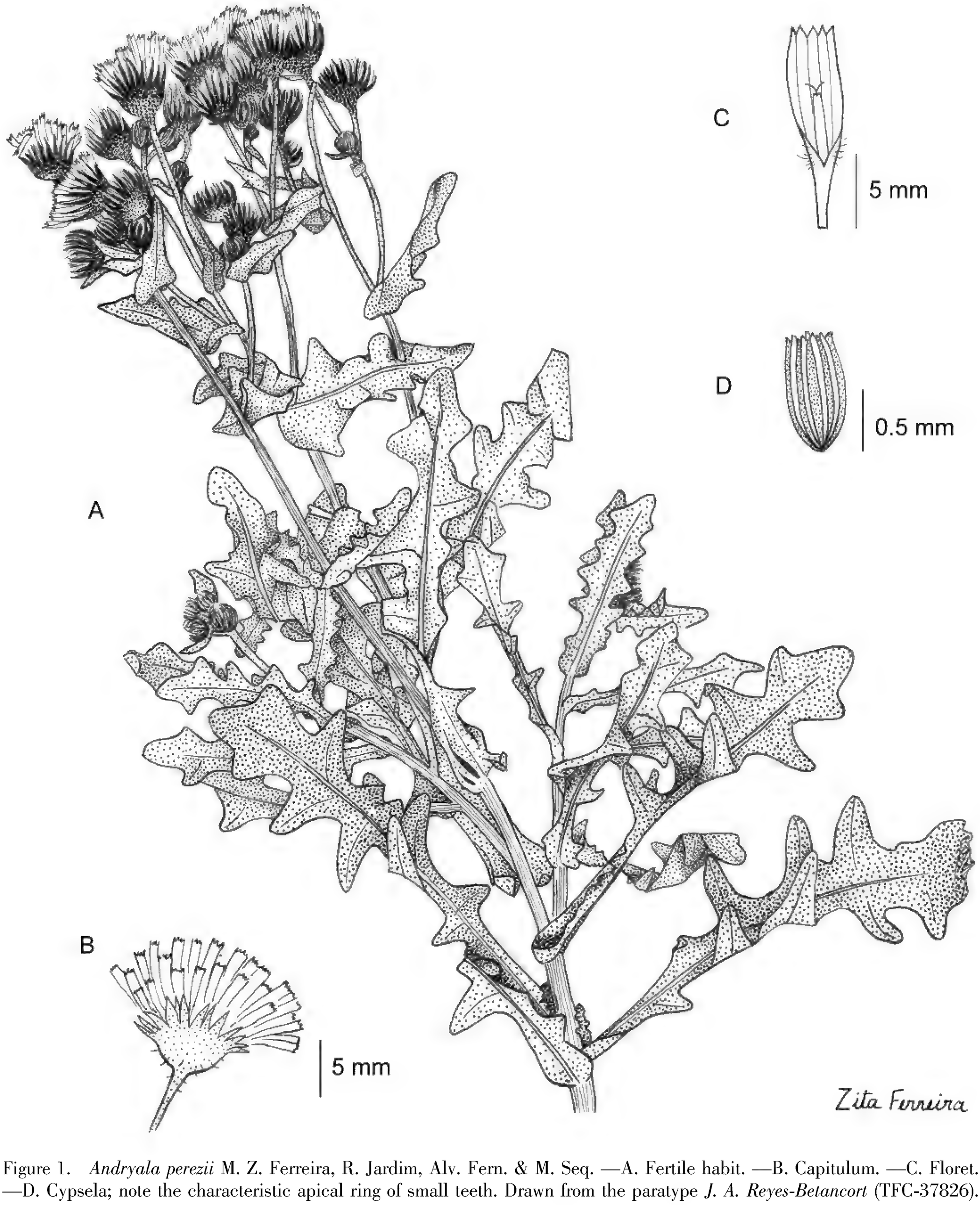


Figure 1. *Andryala perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq. —A. Fertile habit. —B. Capitulum. —C. Floret. —D. Cypsela; note the characteristic apical ring of small teeth. Drawn from the paratype *J. A. Reyes-Betancort* (TFC-37826).

(2004). More recently, A. Santos Guerra and J. A. Reyes-Betancort (in Greuter & von Raab-Straube, 2009) excluded these populations from *A. glandulosa* and included them again in *A. pinnatifida* as *A. pinnatifida* subsp. *buchiana*.

The examination of herbarium specimens demonstrated the presence of a distinct taxon exclusively from Lanzarote and Fuerteventura, and accordingly a new species is described herein.

1. Andryala perezii M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq., sp. nov. TYPE: Spain. Lanzarote: Haría, altos del Bco de Chafarís, 23 Feb. 1994, *J. A. Reyes-Betancort*, *W. W. de la Torre & P. L. Pérez de Paz s.n.* (holotype, TFC-39728). Figures 1, 2.

Andryala pinnatifida Aiton f. *buchiana* Sch. Bip. Hist. Nat. Iles Canaries (Phytogr.). 2: 415. 1849. p.p. quoad.

Andryala pinnatifida Aiton subsp. *buchiana* (Sch. Bip.) Reyes-Bet. & A. Santos in *Willdenowia* 39: 328. 2010. p.p. quoad.

Nova plantarum species quae ab *Andryala pinnatifida* Aiton caulibus indumentum densius ostendentibus, foliis congestioribus marginibus undulatis utrinque aequaliter tomentosis trichomatibus stellatis, pedunculis longioribus et cypselarum annuli apicalis dentibus costarum extensiones subaequentibus; ab *A. glandulosa* Lam. caulibus foliisque stellato-tomentosis sed trichomatibus glandulosis carentibus; ab ambabus pedunculis complanatis ad capitulorum basem ampliatis differt.

Plants from basal rosettes; stems 10–25 cm, woody at the base, branched from the base or from the middle upward, branches erect to patent (sometimes slightly ascending), with a dense tomentum of whitish stellate trichomes (Fig. 3A). Leaves congested at base of stem; leaf blades grayish white or glaucous, tomentose with dense stellate trichomes (Fig. 3B) on both surfaces, lower leaves 93–95 × 25–40 mm, narrowed at the base into a winged petiole 21–24 mm, oblong to lanceolate, lamina deeply lobed to pinnatisect, margin crispate-undulate, the apex acute; cauline leaves 31–66(–92) × 12–29 mm, cordate at the base, semiamplexicaul or amplexicaul, oblong, lamina pinnatifid or deeply lobed, margin crispate-undulate, the apex obtuse; upper leaves 8.3(–13)–21.7 × 2.3–8.6 mm, amplexicaul, ovate-oblong to ovate-lanceolate, entire, cordate at the base, the apex acute to acuminate. Inflorescences in corymbs of 3 to 8 heads; capitula 15–22 mm diam.; peduncles 26–43 mm, flattened and enlarged at the base of the capitulum, with dense stellate trichomes and few glandular trichomes (Fig. 3C); involucre 10–12 × 11–18 mm, ± hemispherical with involucral bracts in 2 or 3 rows; outer involucral bracts 7–7.5 × 1.2–1.6 mm, apex acuminate to subulate, involute enclosing a floret, the external surface with dense white or yellowish stellate trichomes and also abundant glandular trichomes 1.2–1.9 mm, especially along the middle nerve, the trichomes usually yellow or dark at the base; inner involucral bracts 6.5–8 × 1.5–2.3 mm, with narrow scariose margins; the receptacle convex, puberulous to tomentose, with long silky trichomes 3.3–4.2 mm (3 to 4 times longer than the cypselae). Florets ligulate, golden-yellow, tube 4–6.5 mm and ligule 7.4–10 × 1.9–3.1 mm, anther tube ca. 3 mm and style arms 1–2 mm. Cypselae 0.9–1.1 × 0.4–0.5 mm (Fig. 3D), oblong, dark brown with brownish red ribs; the apex with an inner ring of short teeth, as long as the outer (i.e., the prolongation of the ribs); pappus of white bristles 4.8–5.2 mm.

Distribution, habitat, and IUCN Red List category. *Andryala perezii* is found in Lanzarote and Fuerteventura, where it is common on rocky slopes, growing also on roadsides and volcanic substrates, at elevations from 90 to 580 m. Kunkel (1977) considered the Canarian *A. glandulosa* (i.e., *A. perezii*, as treated here) locally common in both islands, despite grazing by rabbits and goats, and did not regard it as a threatened taxon. *Andryala perezii* was evaluated under the name *A. glandulosa* for the Canary Islands and was not included in the *Red Data Book of the Canarian Flora* (Beltrán Tejera et al., 1999), nor was it mentioned in "Memoria de Evaluación de Especies Amenazadas de Canarias 2009" (Servicio de Biodiversidad del Gobierno de Canarias, 2009). Although *A. perezii* has a restricted distribution in the Canary Archipelago, it is locally common in parts of its range and therefore should be listed as Least Concern (LC) according to IUCN Red List categories and criteria (IUCN, 2001).

Etymology. *Andryala perezii* is named in honor of the botanist Pedro Luís Pérez de Paz (1949–), University of La Laguna (Tenerife), who has greatly contributed to the knowledge of the Canary Islands flora and is a co-collector of the type specimen.

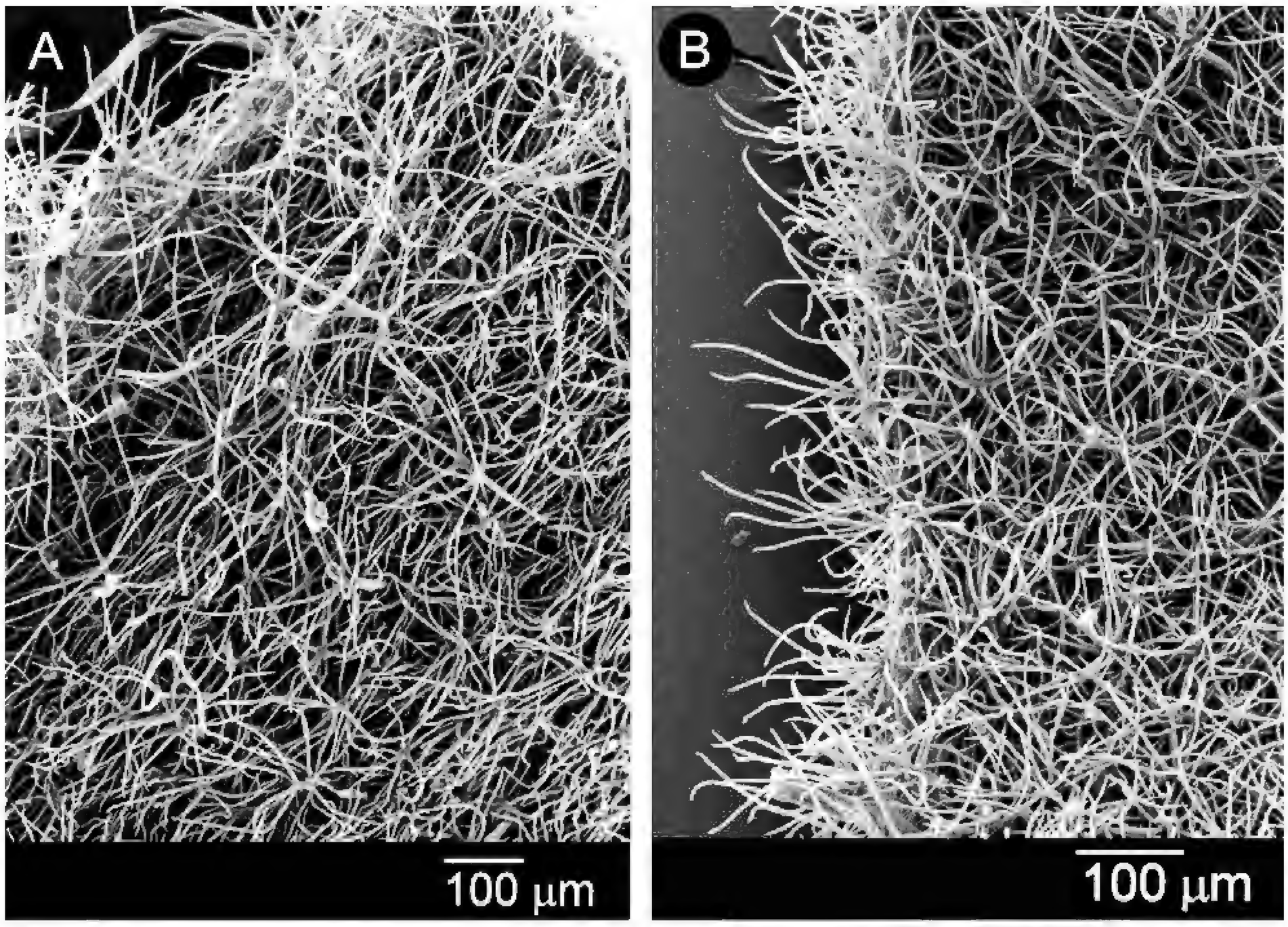
Karyology. Borgen (1970: 150) and Van Loon (1974: 155) counted 18 chromosomes in root tips of plants collected in Lanzarote, originally identified as *Andryala cheiranthifolia*. A careful observation of the herbarium voucher of the plant on which Borgen (1970) performed the chromosome counts made it clear that this specimen corresponds to the newly described species. These chromosome numbers correspond to all other counts known in the genus *Andryala* (e.g., Humphries et al., 1978; Moore, 1982; Goldblatt, 1988; Goldblatt & Johnson, 1990; Castroviejo & Valdés Bermejo, 1991; Pastor Díaz, 1992).

Taxonomic remarks. In the original description of *Andryala glandulosa*, Lamarck (1783) referred to its 3-foot stem height and the glandular pubescence observed on the branches, leaves, peduncles, and involucral bracts, as well as the sessile, lanceolate, and entire leaves. This morphology corresponds undoubtedly to the Madeiran populations of *A. glandulosa*, and the name was therefore misapplied to plants from the Canary Islands by several authors (e.g., Lid & Lid, 1967; Kunkel, 1980; Bramwell & Bramwell, 2001). Lamarck (1783: 154) was uncertain about the origin of this species ("Elle provient, je crois, de graines du voyage de Cook"). However, the likelihood of a Madeiran origin for material of *A. glandulosa* is quite high. James Cook, in his first voyage around the world, reached Madeira in September 1768. On board were the naturalists Sir



Figure 2. Holotype of *Andryala perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq., collected by *J. A. Reyes-Betancort, W. W. de la Torre & P. L. Pérez de Paz* (TFC-39728).

Joseph Banks and D. C. Solander, who investigated the natural history of Madeira during the few days spent on the island (Silva & Menezes, 1998), but their plant list was never published. The uncertainty on the seed origin for Lamarck's *A. glandulosa* suggests another possibility: that the seeds correspond to later collections by Francis Masson (1741–1805). Between 1776 and 1779 Masson undertook



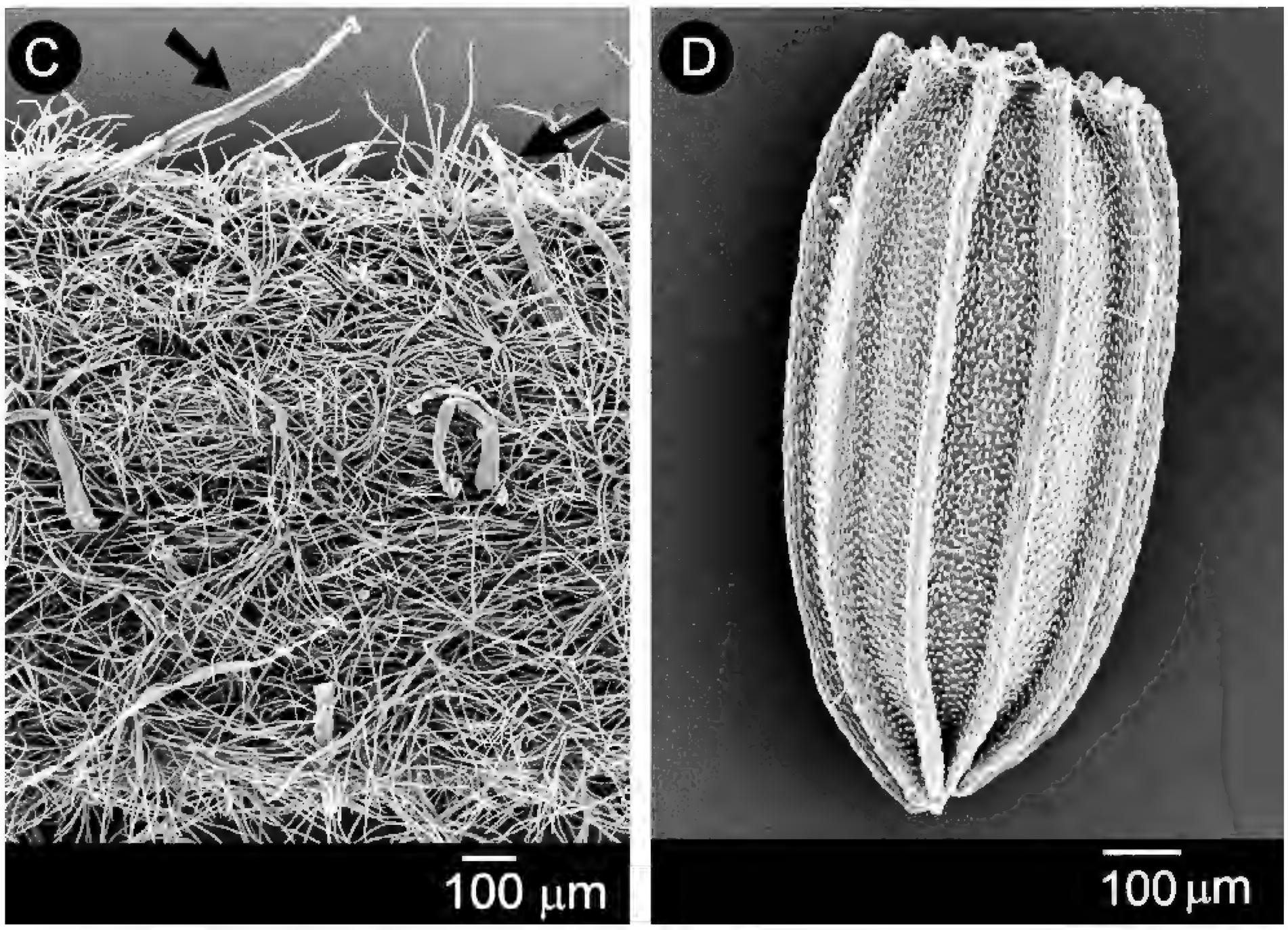


Figure 3. *Andryala perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq. —A. Stem indumentum, tomentose with stellate trichomes. —B. Leaf indumentum, showing the abaxial blade surface as tomentose stellate. —C. Peduncle indumentum, densely stellate, with scattered glandular trichomes. —D. Longitudinal view of cypsela, showing the distinctive apical ring of teeth equivalent in height to the cypsela rib prolongations.

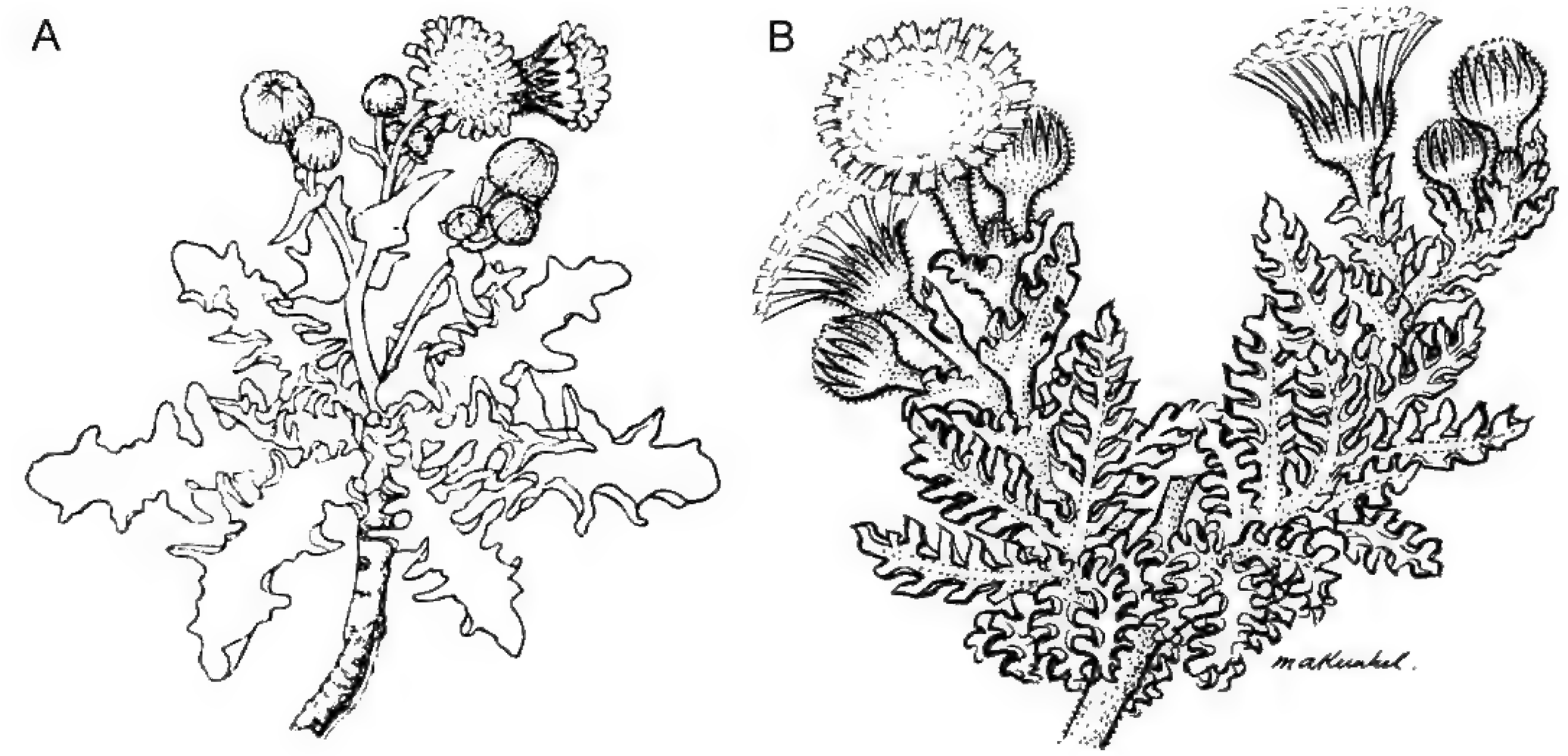


Figure 4. —A. Illustration of *Andryala cheiranthifolia* L'Hér. from the Canary Islands by Dagny Tande Lid, *Contributions to the Flora of the Canary Islands*, 1967. © Dagny Tande Lid/BONO 2013. —B. Illustration of *A. glandulosa* Lam. from Kunkel (1978). Reprinted with permission from Organismo Autónomo Parques Nacionales.

extensive plant collecting in Macaronesia, and Madeira was the main hub for his collecting activities (Francisco-Ortega et al., 2008). These plants were the basis for the description of many new species, including several by L'Héritier, but not *A. cheiranthifolia* (Francisco-Ortega et al., 2008).

The illustration of *Andryala glandulosa* in Poiret's *Tableau Encyclopedique* (1823: pl. 567) does not correspond to the protologue published in 1783 by Lamarck. The specimen illustrated better resembles, by its lanceolate and deeply divided lower leaves, *A. cheiranthifolia* [≡ *A. glandulosa* subsp. *cheiranthifolia*]. When L'Héritier described *A. cheiranthifolia* in 1784, he explicitly assigned it to Madeira, although he was referring to a plant grown in what he noted was the "Hortus regius Parisiensis" (L'Héritier, 1784). Lid and Lid (1967) later accepted *A. cheiranthifolia* for the Canary flora, and the illustration presented by these authors corresponds taxonomically to the newly described *A. perezii* (Fig. 4A). Kunkel (1978) described the Canarian *A. glandulosa* as an herb, 10–25 cm tall, woody at the base, with smooth, whitish, and velvety, pinnapartite or pinnatisect leaves, as well as yellow and rather large capitula. This description was accompanied by an illustration (Fig. 4B), and both fit the new species perfectly.

Schultz Bipontinus (1849: 416) described *Andryala pinnatifida* f. *buchiana* and comprehensively discussed its morphology and distribution, assigning it to the Canary Islands of Tenerife ("in campis villa Orotava usque ad summitatem Cumbre Lagunæ") and Lanzarote ("in summo monte Chache et ad oppidulum Haría"). In respect to the plants from Lanzarote, Schultz Bipontinus (1849: 416) expressed some doubt about their taxonomic position: "*Andr. pinnatifida* var. *major*? an *Andr. cheiranthifoliæ var.*?" For this island (specifically at "la Mancha Blanca") the author described a unique specimen that matches *A. perezii* given its description ("caule abbreviato, palmari, robusto, foliis profundius pinnatifidis, valde undulatis, lobis triangularibus, obtusis, subintegris, capitulos majoribus, corymbosis, floribus aureis, involucro, pilis glanduliferis, flavo-virentibus, præcipue basi hispidissimo"). However, included in *A. pinnatifida* f. *buchiana*, this author also considered a specimen from Tenerife ("ad rupes atlas, de las Mercedes") that, by its description ("folia subcuneata, paulo angustiora, sinuato-dentata, dentius non tam obtusis, supra glabrescentia, capitula corymboso-racemosa, minora, involucra cum pedunculis hispida, flores pallide aurei"), corresponds, together with *A. pinnatifida* f. *cuneifolia* Sch. Bip., to the much later described *A. pinnatifida* var. *latifolia* Bornm., assigned by Bornmüller (1904) to Tenerife and El Hierro and usually not accepted by authors of the Canarian flora (e.g., Acebes Ginovés et al., 2010). This taxon was later combined by Kunkel (1980) as *A. pinnatifida* subsp. *latifolia* (Bornm.) G. Kunkel. Not surprisingly, Schultz Bipontinus (1849) stressed that *A. pinnatifida* f. *cuneifolia*, from El Hierro, is close to *A. pinnatifida* f. *buchiana*, particularly to the specimen from Tenerife. It is obvious that the

Table 1. Diagnostic characters of *Andryala perezii* compared with *A. glandulosa* and *A. pinnatifida*.

Characters	*A. perezii*	*A. glandulosa*	*A. pinnatifida*
Stems	10–25 cm; woolly stellate, without glandular trichomes	21–112 cm; stellate tomentose, with glandular trichomes at least in the upper part	14–81 cm; stellate pubescent or tomentose with glandular trichomes or not
Leaf blades	not pale to dark green, but grayish white or glaucous; all densely stellate tomentose on both surfaces, without glandular trichomes; margins undulate-crispate	pale to dark green, not glaucous; uppermost leaves stellate and glandular pubescent; cauline and basal leaves sometimes glandular pubescent; margins not undulate-crispate	grayish white, pale, or dark green, not glaucous; stellate pubescent more so abaxially; uppermost leaves sometimes glandular pubescent; margins not undulate-crispate
Peduncles	26–43 mm; flattened and enlarged at bases of capitula; densely stellate tomentose, with a few glandular trichomes	19.2–80 mm; cylindrical and not enlarged at bases of capitula; stellate and densely glandular pubescent	7.6–26 mm; ± cylindrical and not enlarged at bases of capitula; stellate pubescent, with ± abundant glandular trichomes or without
Involucres	outer involucral bracts enclosing the florets	outer involucral bracts enclosing the florets	outer involucral bracts rarely enclosing the florets
Cypselae	0.9–1.1 × 0.4–0.5 mm; reddish brown ribs; apex with an inner ring of short teeth, as long as the outer (i.e., the prolongation of the ribs)	1.1–1.7 × 0.4–0.6 mm; usually whitish ribs; apex with an inner ring of short teeth ± equal to or slightly exceeding the outer (i.e., the prolongation of the ribs)	0.9–1.6 × 0.4–0.5 mm; reddish brown ribs; apex with an inner ring of teeth much shorter than the outer (i.e., the prolongation of the ribs, very pronounced)

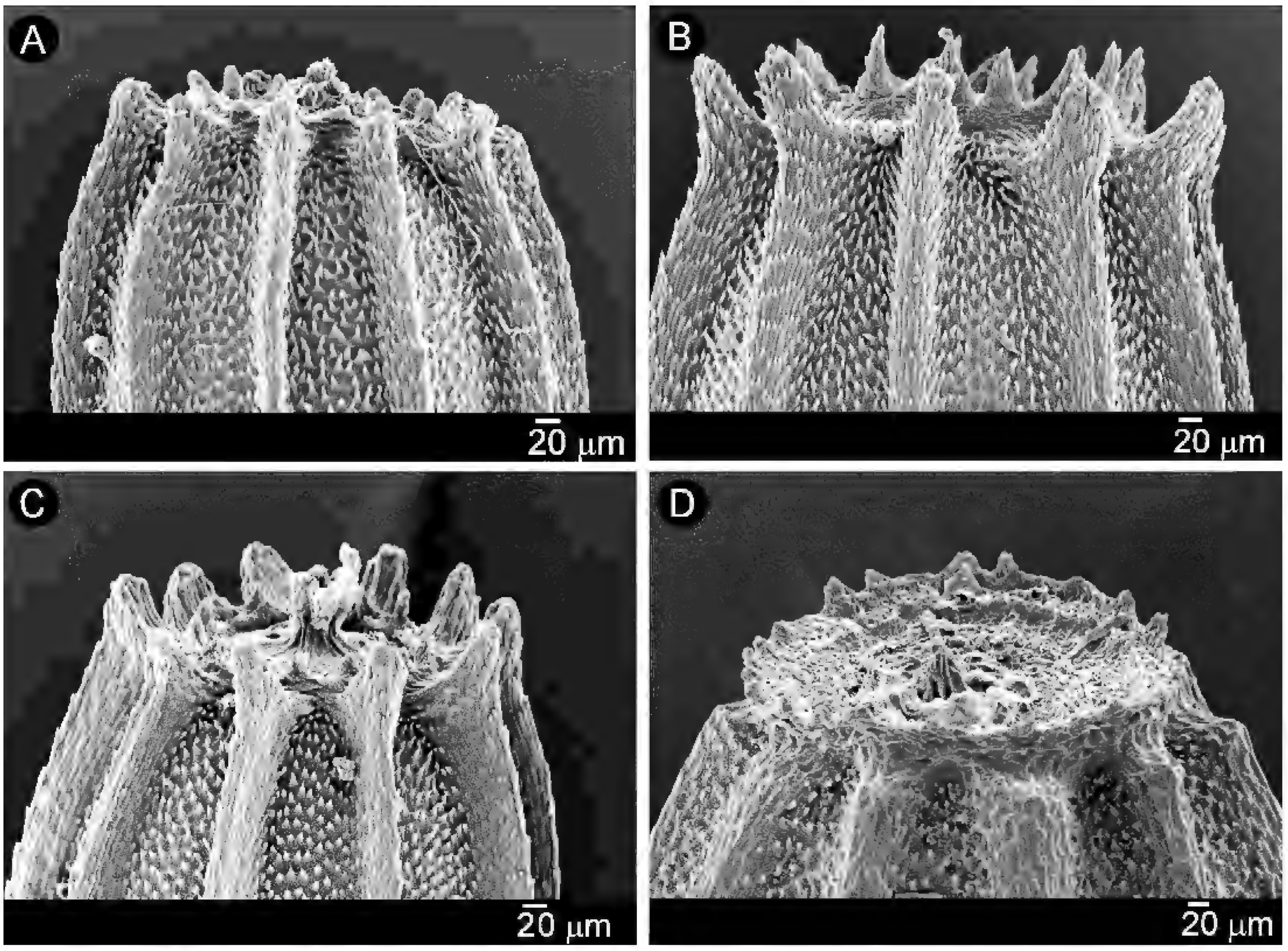


Figure 5. Apex of cypselae. —A. *Andryala perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq., taken from J. A. Reyes-Betancort (TFC-37826). —B. *Andryala glandulosa* Lam., from *Z. Ferreira, M. Sequeira & A. Pupo Correia MA-801899*. —C. *Andryala pinnatifida* Aiton subsp. *preauxiana* (Sch. Bip.) G. Kunkel from the Canary Islands, taken from *C. Suárez & G. Rodríguez* (TFC-31801). —D. *Andryala pinnatifida* Aiton subsp. *mogadorensis* (Hook. f.) Greuter from North Africa, taken from *Z. Ferreira & I. Á. Fernández* (MA-870318).

specimens from Lanzarote and Tenerife referred by Schultz Bipontinus belong to two different taxa. The specimens corresponding to the Schultz Bipontinus publication were located at the Paris (P) and Florence (FI) herbaria. They are FI-W109935, FI-W109928, and P-02462105, and their observation supports the recognition of two distinct taxonomic entities. The specimens FI-W109928 and FI-W109935, both from Lanzarote, were identified originally as "*Andryala cheiranthifolia* var.?" and only the first includes a note by Schultz Bipontinus: "*A. pinnatifida* f. *buchiana* C. H. Schultz. Bip." In 2005, Santos-Guerra annotated on the herbarium sheet FI-W109935 "*Andryala pinnatifida* Ait. f. *buchiana* typus." Apparently he ignored the existence of P-02462105, the specimen from Tenerife that was clearly identified as *A. pinnatifida* f. *buchiana* by Schultz Bipontinus himself. Furthermore, all information on the herbarium label is in conformity with the one in the protologue, including the collector number, which means that P-02462105, having no other name associated with it, is to be considered the lectotype of *A. pinnatifida* f. *buchiana*. Thus, herbarium material (FI-W109928 and FI-W109935), as well as earlier literature, support specimens from Lanzarote as taxonomically concordant with *A. perezii*, here excluded from *A. pinnatifida* f. *buchiana*. Later the plants from Lanzarote, corresponding to the application of the name *A. glandulosa* to the east Canarian plants, were recognized as *A. pinnatifida* subsp. *buchiana* (Greuter & von Raab-Straube, 2009), but no lectotype was designated. Moreover, Santos-Guerra and Reyes-Betancort, when publishing *A. pinnatifida* subsp. *buchiana* as a transfer in rank from form to subspecies, did not mention that the taxon originally included elements from both Tenerife and Lanzarote. Given the confusion attached to the name *A. pinnatifida* f. *buchiana* and to the respective protologue (indeed, three descriptions in total), and taking into account the morphological differences between the specimens from Tenerife and Lanzarote, we have chosen to recognize the eastern Canary plants (from Lanzarote and Fuerteventura) as a new species with a new type, *A. perezii* M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq.

The description of the Tenerife plants by Schultz Bipontinus and the specimen (P-02462105) better match *Andryala pinnatifida* f. *cuneifolia*. The later described *A. pinnatifida* var. *latifolia* clearly corresponds to the previously described taxon, hereby recognized at the rank of subspecies.

2. Andryala pinnatifida Aiton, Hort. Kew. [W. Aiton] 3:129. 1789. TYPE: Spain. Canary Islands, Tenerife, 1778, *Fr. Masson* (lectotype, designated here, BM000753022).

2a. Andryala pinnatifida Aiton subsp. **cuneifolia** (Sch. Bip.) M. Z. Ferreira, R. Jardim, Alv. Fern. & M. Seq. stat. nov. Basionym: *Andryala pinnatifida* Aiton f. *cuneifolia* Sch. Bip., Hist. Nat. Iles Canaries (Phytogr.). 2: 417. 1849. TYPE: Spain. El Hierro, Monte Savinosa, 18 June 1845, *Bourgeau n°. 9* (lectotype, designated here, P02462115).

Andryala pinnatifida Aiton f. *buchiana* Sch. Bip. Hist. Nat. Iles Canaries (Phytogr.). 2: 415. 1849. TYPE: Spain, Canary Islands, Tenerife: contre les rochers élevésde las Mercedes, 9 June 1846, *Bourgeau, n° 7* (lectotype, designated here, P02462105).

Andryala pinnatifida Aiton subsp. *latifolia* (Bornm.) G. Kunkel in Vieraea 8: 344. 1980, syn. nov. Basionym: *Andryala pinnatifida* Aiton var. *latifolia* Bornm., Bot. Jahrb. Syst. 33: 489. 1904. TYPE: Spain. Canary Islands, Tenerife: Cumbre de Anaga, 27 June 1901, *Bornmüller, n°. 863* (lectotype, designated here, P02462137; isolectotype, JE00013921).

Further, the publication of a new species name is strongly supported by the fact that *Andryala perezii* differs remarkably from the Madeiran *A. glandulosa* (e.g., indumentum, leaf margins, peduncle shape, and cypsela size), as well as from the Canarian *A. pinnatifida* taxa (e.g., indumentum, leaf margins, involucre shape, and cypsela apex). Table 1 summarizes the diagnostic characters of *A. perezii* versus *A. glandulosa* and the Canarian *A. pinnatifida*. The new species is also notably distinct from the North African *A. pinnatifida* taxa, namely with regard to leaf margin, involucre indumentum, involucre bract margin, and apex of cypsela, the latter being an important diagnostic feature within the genus *Andryala*. In all North African *A. pinnatifida* subspecies, the cypsela apex is quite distinct compared to that in *A. perezii*, *A. glandulosa*, and *A. pinnatifida* from the Canary Islands. *Andryala pinnatifida* subsp. *mogadorensis* (Hook. f.) Greuter is presented as an example: the ribs at the apex of the cypsela are not extended, and the inner ring of teeth is larger in diameter (Fig. 5).

KEY TO THE MACARONESIAN SPECIES OF *ANDRYALA*

1a. Cauline leaves crowded, deeply pinnatisect; all flowers with ligule teeth stellate pubescent ..... *A. crithmifolia*
1b. Cauline leaves entire to pinnatisect (if pinnatisect, never crowded); ligule teeth not stellate pubescent, seldom a few flowers scarcely so. ..... 2.

2a. Leaves usually more stellate pubescent abaxially, cypsela apical ring with teeth much shorter than the prolongation of the ribs ..... *A. pinnatifida*
2b. Leaves equally stellate pubescent on both faces, cypsela apical ring with teeth ± equaling or exceeding the prolongation of the ribs. ..... 3.
3a. Involucral bracts subulate, receptacular trichomes not longer than the cypsela, cypsela apical ring with teeth largely exceeding the prolongation of the ribs ..... *A. laxiflora*
3b. Involucral bracts acute to acuminate or seldom subulate, receptacular trichomes longer than the cypsela, cypsela apical ring with teeth ± equaling or slightly exceeding the prolongation of the ribs... 4.
4a. Therophyte to hemicryptophyte plants; involucral bracts flat, not enfolding a floret ... *A. integrifolia*
4b. Chamaephyte or seldom hemicritophyte plants; external involucral bracts involute, enfolding a floret. ..... 5.
5a. Stems stellate tomentose and glandular pubescent at least in the upper part, uppermost leaves glandular pubescent and sometimes stellate tomentose; peduncles cylindrical and not enlarged at the base of the capitula, densely glandular pubescent ..... *A. glandulosa*
5b. Stems densely stellate tomentose but not glandular pubescent, all leaves stellate tomentose but not glandular pubescent; peduncles somewhat flattened and enlarged at the base of the capitula, with a few glandular trichomes ..... *A. perezii*

Key to the Macaronesian *Andryala pinnatifida* Subspecies

1a. Plants without glandular trichomes; stems up to 90 cm; cauline leaves pinnatisect (with linear segments) to linear pinnatifid-dentate; capitula arranged in racemes ..... *A. pinnatifida* subsp. *teydensis*
1b. Plants usually with glandular trichomes; stems up to 75 cm; cauline leaves pinnatipartite to dentate with broader, never linear segments; capitula arranged in racemes or corymbs ..... 2.
2a. Stems stellate tomentose to densely stellate tomentose below; leaves lanceolate to ellipitic-lanceolate; inflorescence usually corymbose-racemose, sometimes racemose; peduncles without glandular trichomes or with glandular trichomes 0.3–1.5 mm long ..... 3.
2b. Stems usually stellate puberulous to finely stellate tomentose below; leaves obovate, obovate-cuneate to subcuneate, or elliptic; inflorescence corymbose; peduncles always with glandular trichomes 1–2.8 mm long ..... 4.
3a. Lower leaves narrow (2–3 cm wide), lanceolate, pinnatifid with entire lobes; peduncles 0.5–2 cm long ..... *A. pinnatifida* subsp. *pinnatifida*
3b. Lower leaves broad (3–6 cm wide), lanceolate or elliptic-lanceolate, pinnatifid to pinnatipartite with divided lobes; peduncles 0.8–3 cm long ..... *A. pinnatifida* subsp. *preauxiana*
4a. Stems sometimes purplish; leaves not crowded, obovate or elliptic, dentate, abaxial surface stellate tomentose ..... *A. pinnatifida* Aiton subsp. *webbii* (Sch. Bip. ex Christ) G. Kunkel
4b. Stems never purplish; leaves crowded, obovate-cuneate to subcuneate, sinuate to sinuate-dentate, abaxial surface stellate lanate ..... *A. pinnatifida* subsp. *cuneifolia*

Paratypes. SPAIN [CANARY ISLANDS]. **Fuerteventura:** Pico del Fraile, 24 July 1979, *A. Banãres* (TFC-21147). **Lanzarote:** Risco de Famara, 25 Mar. 1975, *J. R. Acebes & P. L. Pérez de Paz* (TFMC-1770); Risco de las Nieves, 19 Jan. 1983, *M. del Arco Aguilar, P. L. Pérez de Paz & W. Wildpret de la Torre* (TFC-28870); Teguise, casas de Famara, 4 Apr. 2006, *C. Aedo, L. Medina & A. Quintanar*, CA12532 (MA-750660); Haría, riscos de Famara, penas de Chache, 3 Apr. 2006, *C. Aedo, L. Medina & A. Quintanar*, CA12417 (MA-751304); San Bartolomé, Monte Medina, 7 Apr. 2006, *C. Aedo, L. Medina & A. Quintanar*, AQ1846 (MA-750866); Montanã Blanca, 31 Mar. 1994, *J. A. Reyes-Betancort* (TFC-37826).

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Opuntia tezontepecana, una Nueva Especie de Cactaceae del Estado de Hidalgo, México

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Resumen. Se describe una nueva especie de *Opuntia* Mill. (Cactaceae), endémica del Municipio de Villa de Tezontepec, Estado de Hidalgo, México. Los lugareños la llaman xoconostle de invierno (en náhuatl, xoco = ácido; noxtle = tunas). Se compara *O. tezontepecana* Gallegos-Vázquez & Scheinvar con dos especies simpátricas de epidermis glabra a simple vista y pulverulenta bajo microscopía electrónica de barrido: *O. joconostle* F. A. C. Weber y *O. matudae* Scheinvar, también productoras de xoconostles. Se ha observado sus cladodios maduros anchamente elípticos, aréolas de ocho o nueve series, espinas en todas las aréolas; espinas y glóquidas estructuralmente diferentes de aquellas en las simpátricas; pericarpelo con tubérculos inconspicuos, aréolas? sin espinas, las superiores con uno o dos cerdas; frutos elipsoides, con la cicatriz floral ligeramente hundida, con epidermis brillante, verde clara con manchas rojo-anaranjadas, paredes anchas, ácidas, rosadas, comestibles; funículos secos a semisecos e insípidos, semillas características. Las aves solo perforan las paredes del fruto en búsqueda de sus funículos. Los frutos permanecen más de 15 meses sobre los cladodios.

Abstract. A new species of *Opuntia* Mill. (Cactaceae), endemic to the region of Villa de Tezontepec, in the state of Hidalgo, Mexico, is described. Farmers in the region call it "winter xoconostle" (in náhuatl, "xoco" = "acid"; "noxtle" = "tunas"). *Opuntia tezontepecana* Gallegos-Vázquez & Scheinvar is compared with the two sympatric species that have a glabrous epidermis to the unaided eye, but are pulverulent under SEM: *O. joconostle* F. A. C. Weber and *O. matudae* Scheinvar, both xoconostles. We observed the following distinctive characteristics in the new species: the mature cladodes as widely elliptic, the areoles in eight or nine series, spines on all areoles; spines and glochids structurally different from those of the sympatric species; the pericarpel with inconspicuous tubercles, without spines, but the superior ones with one or two bristles; fruits ellipsoid, with the floral scar slightly sunken, with a shiny epidermis, light green with red-orange spots, wide walls, acidic, rose-colored, edible; its funicles dry or semi-dry and tasteless, and characteristic seeds. Birds only pierce the walls of the fruit and eat the dry or semi-dry funicles. Fruits remain on the cladodes for 15 months or more.

Key words: Cactaceae, Hidalgo, IUCN Red List, Mexico, *Opuntia*, xoconostle.

La base de datos Especies Silvestres de Nopales Mexicanos, elaborada por Scheinvar et al. (2010) considera 91 especies y 23 subespecies o variedades silvestres del género *Opuntia* Mill. (Cactaceae), en toda la República, distribuidas principalmente en zonas semiáridas. En Hidalgo, se encuentran 34 especies, lo que corresponde al 33.3% del total, distribuidas principalmente en bosques tropicales caducifolios, matorrales xerófilos y pastizales. En el Municipio de Villa de Tezontepec, Hidalgo, se han encontrado seis poblaciones de un nopal que, hasta donde se conoce, se trata de una especie nueva, endémica de esta región, de distribución restringida, nombrada como xoconostle de invierno y cultivada en huertos. Se considera que las poblaciones silvestres son vulnerables debido a las múltiples actividades humanas en la región, tales como las agrícolas, ganaderas, el crecimiento de la mancha urbana, los nuevos e irregulares asentamientos humanos, la instalación de líneas telefónicas y eléctricas, el trazo y/o ampliación de caminos y carreteras, la construcción de presas hidroeléctricas, etc., que llevan a la pérdida de las áreas naturales de las especies silvestres. En el mismo Municipio se encuentran distribuidas otras dos especies silvestres productoras

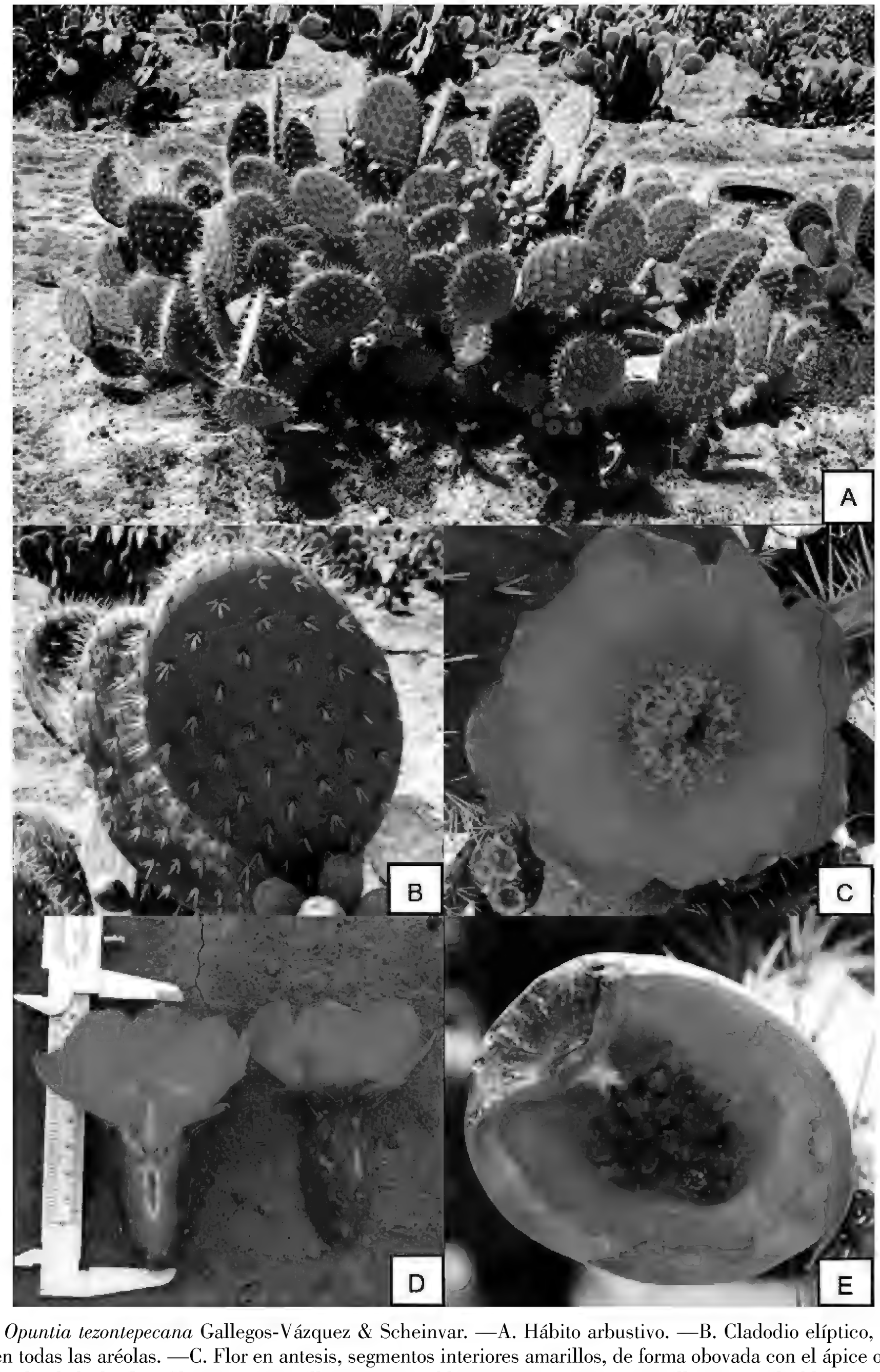


Figura 1. *Opuntia tezontepecana* Gallegos-Vázquez & Scheinvar. —A. Hábito arbustivo. —B. Cladodio elíptico, con espinas presentes en todas las aréolas. —C. Flor en antesis, segmentos interiores amarillos, de forma obovada con el ápice obtuso. —D. Corte longitudinal de la flor, filamentos amarillos y anteras blancuzcas con tonos amarillentos, estilo blanco y lóbulos del estigma verdes. —E. Fruto de forma elipsoide, paredes anchas rosadas, semillas dispuestas en el centro del fruto con funículos secos o semisecos. Villa de Tezontepec, Hidalgo. Fotos César Martínez.

de xoconostles (en náhuatl, xoco = ácido; noxtle = tunas): *O. joconostle* F. A. C. Weber y *O. matudae* Scheinvar (Scheinvar et al., 2010) con epidermis glabra a simple vista y pulverulenta bajo el microscopio electrónico de barrido, con las que se hace un estudio comparativo.

Opuntia tezontepecana Gallegos-Vázquez & Scheinvar, sp. nov. TIPO: México. Hidalgo: Mpio. Villa de Tezontepec, Villa de Tezontepec, 19°53′0.5″N, 98°48′43″W, 2323 m.s.n.m., *C. Gallegos-Vázquez 334 & L. Scheinvar 8124* (holotipo, MEXU; isotipos, ARIZ, CHAPA, MO). Figuras 1–2.

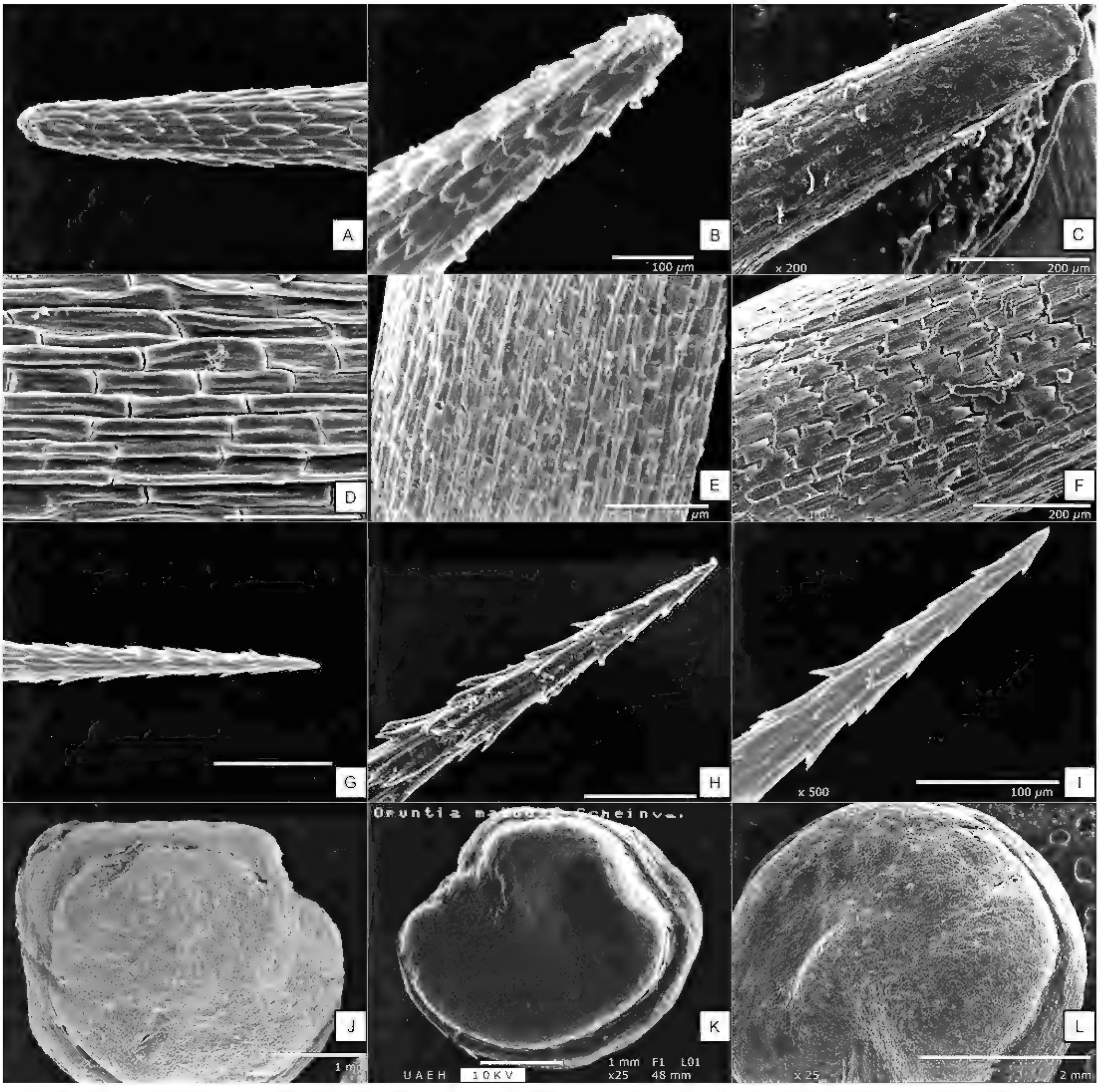


Figura 2. Estructuras comparativas de espinas, glóquidas y semillas. —A. Parte apical de una espina de *Opuntia joconostle* (×250). —B. Parte apical de una espina de *O. matudae* (×300). —C. Parte apical de una espina de *O. tezontepecana*. —D. Parte mediana de una espina de *O. joconostle* (×400). —E. Parte mediana de una espina de *O. matudae*. —F. Parte mediana de una espina de *O. tezontepecana*. —G. Parte apical de una glóquida de *O. joconostle* (×280). —H. Parte apical de una glóquida de *O. matudae*. —I. Parte apical de una glóquida de *O. tezontepecana* (×350). —J. Semilla de *O. joconostle*. —K. Semilla de *O. matudae* (×30). —L. Semilla de *O. tezontepecana* (×25). Fotos: B, Mendoza-Gárfias y D, Ordoñez-Barrios, MEB, IB-UNAM.

Diagnóstico. The new species is similar to the sympatric species *Opuntia joconostle* F. A. C. Weber ex Diguet and *O. matudae* Scheinvar by the epidermis that is glabrous to the naked eye but pulverulent under SEM, but differs from them by the following characters: cladodes broadly elliptic, the terminal ones 22–42 × 17–29 cm, ca. 2.5 cm thick; areoles arranged in 8 or 9 series; spines 1 to 8(9) in all areoles, subulate, reflexed, apex and base yellow, emerging from areole base; pericarp elliptical, with inconspicuous tubercles, areoles spineless but the superior with 1 or 2 bristles, 1 cm long; style white, stigma lobes 8, light green; fruits ellipsoid, with a shiny skin, light green with red-orange spots, with thick walls, acidic, rose-colored, edible; funicles dry or semi-dry, tasteless; mature fruit persistent, observed on cladodes for 15 months or more.

Planta arbustiva, de 160 cm de altura (Fig. 1A); tronco de 12 cm de alto y 30 cm de diámetro; corteza lisa, amarillenta, sin aréolas; epidermis glabra a simple vista y pulverulenta bajo microscopio electrónico de barrido, recubierta de gran cantidad de cera. Cladodios maduros anchamente elípticos, 22–42 × 17–29 cm y ca. 2.5 cm de espesor, de color verde claro grisáceo (Fig. 1B); podarios inconspicuos; aréolas dispuestas en 8 o 9 series, 3.8 cm distantes entre sí y 4 cm entre series, elípticas a subcirculares, de 0.4–0.5 × 0.3–0.4 cm, con fieltro corto grisáceo, las superiores rodeadas de un anillo suberificado,

Cuadro 1. Características distintivas de tres especies de *Opuntia* productoras de xoconostles, distribuidas en la región de Hidalgo.

Características	*O. tezontepecana* Gallegos & Scheinvar	*O. joconostle* F. A. C. Weber	*O. matudae* Scheinvar
Forma del cladodio adulto	obovado, pasando a anchamente elíptico	obovado	angostamente obovado
Numero de series de aréolas en cladodios	8–9	7–9	9–10
Color de las espinas en cladodios maduros	blancas, con el ápice amarillento	blancas, con el ápice ambarino	blanco grisáceo, con el ápice translúcido
Pericarpelo forma	elipsoide	obovado	obovado
Pericarpelo dimensiones	3.5–4 × 2.5–3.2 cm	2.5–3 × 2–2.3 cm	2–2.7 × 1.7–2 cm
Podarios pericarpelo	inconspicuos	conspicuos	conspicuos
Filamentos	amarillos	blancos	amarillos
Estilo color	blanco	blanco-rosado	rosa claro
Fruto color	verde claro con manchas rojo-anaranjadas	blanco-verdoso	verde-purpúreo
Fruto dimensiones	6.5–7 × 4.5–5 cm	3–4 × 1.6–2.8 cm	2.5–4 × 1.5–2.5 cm
Fruto forma	elipsoide	subgloboso	elipsoide a piriforme
Color de las paredes fruto	rosadas	blancas o rosadas	rosa-rojizas
Grosor de las paredes del fruto	2–2.5 cm	1.4–1.9 cm	1.5–1.7 cm
Cicatriz floral	ligeramente hundida	hundida	hundida
Semillas	reniformes a lenticulares, ca. 0.3 cm diám.	anguladas, ca. 1.5 cm diám.	discoides, ca. 3 mm diám.

amarillento; glóquidas amarillas, ca. 0.4 cm, conniventes, dispuestas en la parte superior de la aréola; espinas 1 a 8(9), presentes en todo el cladodio, emergen de la parte inferior de la aréola, todas radiales, subuladas, divergentes y reflejas, en los bordes de los cladodios son desiguales, blancas, con la base y el ápice amarillentos, una porrecta, de 0.6–2.7 cm; espinas (Fig. 2A–F) y glóquidas (Fig. 2G–I) estructuralmente diferentes de las simpátricas; cladodios juveniles con tubérculos oblongos, delimitados por depresiones punteadas amarillas, aréolas con fieltro de color rosado-cremoso, con escama basal subulada, erecta, angosta, verde con el ápice uncinado, rojizo. Flores amarillas (Fig. 1C, D), de 9–10.5 cm de largo; pericarpelo elipsoide, de 3.5–4 × 2.5–3.2 cm, con aréolas dispuestas en 5 series, distantes 0.8–1 cm entre sí, con escama basal diminuta, sin espinas, las superiores con 1 o 2 cerdas amarillas, hasta 1 cm de largo, podarios inconspicuos; segmentos exteriores del perianto oblongo-espatulados, ápice apiculado y bordes dentados, amarillos con el ápice rojizo y la base verdosa; segmentos interiores espatulados con la base angosta, ápice emarginado, bordes dentados, ondulados, amarillos, el ápice ligeramente rojizo; estambres 1/3 del largo del perianto, filamentos amarillos y anteras blancuzcas con tonos amarillentos; estilo de 2–2.5 cm, blanco, lóbulos del estigma 8, ca. 0.3 cm, verde claros con estría mediana blancuzca, papilosos. Frutos elipsoides (Fig. 1E), de 6.5–7 × 4.5–5 cm, epidermis brillante, de color verde claro con manchas rojo-anaranjadas; aréolas de 0.2–0.3 cm, con podarios inconspicuos, aréolas elípticas, hundidas, dispuestas en 6 series, con escaso fieltro, sin espinas, en la parte superior con glóquidas amarillas, rodeadas de un anillo amarillo-grisáceo, paredes gruesas, de 2–2.5 cm, rosadas, no se desprenden de los funículos de las semillas, cicatriz floral ligeramente hundida (0.2–0.3 cm), estriada, anaranjada; semillas reniformes a lenticulares, de ca. 0.3 cm diám., de color crema, arilo lateral, irregular, región hilo-micropilar lateral, profunda (Fig. 2L), distinta de las dos simpátricas (Fig. 2J–L), funículos secos o semisecos e insípidos.

Distribución. Municipio de Villa de Tezontepec, Hidalgo, se han observado seis poblaciones silvestres de una especie desconocida y también cultivada en huertos locales, productora de xoconostles. Un estudio comparativo entre estas plantas con todas las especies mexicanas conocidas, productoras de xoconostles, y en especial con las dos especies silvestres de la región: *Opuntia joconostle* F. A. C. Weber ex Diguet, *O. matudae* Scheinvar, nos indicó que se trata de una especie distinta y nueva para la ciencia. En la misma región también se encuentra la *O. oligacantha* C. F. Först. (sensu Scheinvar, taxonomía poco conocida) densamente pilosa y productora de xoconostles, cuyas características son

Cuadro 2. Características compartidas de tres especies de *Opuntia* productoras de xoconostles, distribuidas en la región de Hidalgo.

Características	*O. tezontepecana* Gallegos & Scheinvar	*O. joconostle* F. A. C. Weber	*O. matudae* Scheinvar
Hábito	arbustivo	arbustivo	arbustivo
Epidermis	glabra a simple vista y pubescente bajo el microscopio electrónico de barrido	glabra a simple vista y pubescente bajo el microscopio electrónico de barrido	glabra a simple vista y pubescente bajo el microscopio electrónico de barrido
Tipo de ácido	xoconostle	xoconostle	xoconostle
Persistencia del fruto sobre el cladodio	no se desprenden cuando maduran	no se desprenden cuando maduran	no se desprenden cuando maduran

muy distintas de esta especie nueva, por lo que no la incluimos en los cuadros comparativos.

La nueva especie fue encontrada y colectada por vez primera por C. Gallegos-Vázquez y cultivada en el Rancho de Fidel Orozco, en Villa de Tezontepec, posteriormente en el Centro Regional Universitario Centro-Norte de la Universidad Autónoma Chapingo, en el Depositario Nacional de especies de *Opuntia* (CRUCEN-UACh), Reg. Cult. No. 334 (*C. Gallegos-Vázquez 334*), y en el Jardín Botánico del Instituto de Biología Universidad Nacional Autónoma de México, en la Colección Nacional de Nopales Silvestres Mexicanos.

En el Cuadro 1 se comparan las características distintivas de la nueva especie y las dos especies simpátricas de Villa de Tezontepec y en el Cuadro 2 se indican las características compartidas entre las tres especies.

IUCN Red List Category. Puede ser considerada según la IUCN Red List of Threatened Species (IUCN, 2001, 2007) como Vulnerable (VU), debido a los cambios climáticos actuales y las distintas actividades humanas en la región.

Serie a la cual pertenece. *Opuntia tezontepecana* debe ser incluida en la serie *Heliabravoanae* Scheinvar, donde se ubica *O. heliabravoana* Scheinvar (1974: 85).

Opuntia joconostle, *O. matudae* y *O. tezontepecana* son simpátricas, comparten las siguientes características en común: epidermis glabra a simple vista y pulverulenta bajo microscopía electrónica de barrido y produce frutos xoconostles, con paredes anchas, ácidas, comestibles, no se desprenden de los funículos que son secos o semisecos e insípidos. No se desprenden de los cladodios cuando maduran. (Cuadro 2).

Etimología. El nombre de esta especie se refiere a la localidad en la cual fue observada y colectada por vez primera, Villa de Tezontepec, Hidalgo.

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A New Species of *Eutrema* (Brassicaceae) from Central China

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ABSTRACT. A new species of the genus *Eutrema* R. Br. (Brassicaceae) is described and illustrated from Hubei Province in China. This species is similar to *E. yungshunensis* (W. T. Wang) Al-Shehbaz & Warwick in its leafy stems and ovaries with more than 10 ovules, but the new species differs in having glaucous stems, larger leaves abaxially purplish, larger sepals and petals, and fewer seeds per fruit.

Key words: Brassicaceae, China, *Eutrema*, IUCN Red List, *Neomartinella*.

Eutrema R. Br. (Brassicaceae) consists of 26 species mainly distributed in Asia (Al-Shehbaz & Warwick, 2005). During extensive investigation of the flora in Zhuxi County, Hubei, China, an interesting species of the genus new to science was discovered and is reported here. The new species, *E. zhuxiense* Q. L. Gan & X. W. Li, is similar to *E. yungshunensis* (W. T. Wang) Al-Shehbaz & Warwick in its leafy stems and ovaries with more than 10 ovules. The new species is distinguished from *E. yungshunensis* by having glaucous stems (vs. glabrate but not glaucous), leaves that are abaxially purplish green and larger, 3–16 × 3–16 cm (vs. 2–6 × 1–5 cm, with no purple tint), sepals obovate to spatulate, 2.8–3 × ca. 2.5 mm and larger (vs. ovate, 1.5–2 × 1–1.2 mm), petals obovate and larger, 6–7 × 4–5.5 mm (vs. obcordate, 4–5 × 2–2.5 mm), and generally fewer seeds per fruit that are longer (six to 20 seeds in fruit 5–12 mm vs. 20 to 40 seeds in fruit 1.5–3.5 mm). In addition, *E. yungshunensis* is distributed at lower elevations (500–600 m) and is not sympatric, known only from adjacent Hunan Province to the south.

Eutrema zhuxiense Q. L. Gan & X. W. Li, sp. nov. TYPE: China. Hubei: Zhuxi Co., Taoyuan, Liu-shu-ping, Wangjiashan, 1100 m, 28 Mar. 2007, *Q. L. Gan 1890* (holotype, HIB). Figure 1.

Haec species *Eutremati yungshunensi* (W. T. Wang) Al-Shehbaz & Warwick similis, sed ab eo caulibus glaucis, foliis majoribus abaxialiter purpureis, sepalis et petalis majoribus, seminibus paucioribus et fructibus longioribus differt.

Perennial herbs, 10–55 cm tall; rhizomes fleshy; stems erect, simple, or 2- to 4-branched in distal portion, leafy, few to several from base, glabrous, glaucous. Basal leaves 5 to 16, rosulate; petiole 5–19 cm, glabrous, purple or green; leaf blades ovate or broadly ovate, 3–16 × 3–16 cm, glabrous on both sides, green adaxially, purplish green abaxially, papery, base cordate, margin repand or coarsely dentate, with apiculate callosities, apex obtuse and slightly emarginate; middle cauline leaves 2 or 3, sometimes more, similar to basal ones but smaller, coarsely dentate on leaf margin. Inflorescence a raceme, with 10 to 30 flowers, glabrous, ebracteate; pedicels filiform, 1–3 cm, ascending when fruiting. Flowers with sepals ovate to spatulate, 2.8–3 × ca. 2.5 mm, white or abaxially green in middle portion with the margin being white, easily caduous; petals white, obovate, 6–7 × 4–5.5 mm; filaments white, 2–2.2 mm; anthers ovate, 1.5 mm; ovary oblong, style absent, stigma rounded and flat; ovules 6 to 20 per ovary. Fruit oblong or linear, 5–12 × 1.5–3 mm, terete or slightly compressed, not torulose; valves without evident midvein; seeds rhombic, 1 mm long.

Distribution and habitat. *Eutrema zhuxiense* is endemic to Zhuxi County in Hubei Province in central China. The new taxon grows in damp places or among rocks in montane forests. It has been found from altitudes of 700–1500 m.

IUCN Red List category. *Eutrema zhuxiense* is known from only three populations in Zhuxi County. The three populations have ca. 500 individuals in total. Further study is needed to assess its distribution. At this time, the new species is assessed as Data Deficient (DD) based on IUCN criteria (IUCN, 2001).

Phenology. The authors observed that *Eutrema zhuxiense* flowers from February to March, with fruits seen in April to May.



Figure 1. *Eutrema zhuxiense* Q. L. Gan & X. W. Li. —A. Fertile plant habit. —B. Adaxial and abaxial leaf surfaces. Note the purple tint to the abaxial surface. —C. Anthesal flowers. —D. Mature fruit with ascending pedicels. Photos taken at the type locality by Q. L. Gan & X. W. Li.

Etymology. The specific epithet *zhuxiense* refers to the county of Zhuxi in Hubei Province, China.

Discussion. *Neomartinella* Pilg. can be distinguished from *Eutrema* by its narrower pistil that is linear (vs. oblong) and by the greater number of ovules per ovary ([20 to] 30 to 40 vs. only four to 10]) (Zhou et al., 2001). The pistil of *E. zhuxiense* is oblong, and it has six to 20 ovules per ovary, indicating the species bridges the morphological gaps between *Neomartinella* and *Eutrema*. Our observation supported the union of *Neomartinella* and *Eutrema* (Al-Shehbaz & Warwick, 2005).

Paratypes. CHINA. **Hubei:** Zhuxi Co., Tianbao, Gedong, 700 m, 15 Apr. 2008, *Q. L. Gan 3054* (HIB), 14 Feb. 2011, *Q. L. Gan 3404* (from plants cultivated by Q. L. Gan from the locality as *Q. L. Gan 3054*) (HIB), 20 May 2013, *X. W. Li 1301* (MO).

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A New Species of *Burmeistera* (Campanulaceae, Lobelioideae) from the Western Cordillera of Colombia

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ABSTRACT. *Burmeistera salicifolia* Garzón, Luteyn & F. González (Campanulaceae, Lobelioideae), a new species from the departments of Chocó and Valle del Cauca in Colombia, is illustrated and described, and its affinities are discussed. The species is a small epiphytic to terrestrial herb with a green corolla. It stands out from other species by its narrow leaves with brochidodromous venation; the short, broadly triangular calyx lobes; and the subequal, narrowly ovate-lanceolate corolla lobes that are at right angles with the tube. *Burmeistera salicifolia* is assigned to *Burmeistera* Triana sect. *Burmeistera* because the tips of the ventral anthers lack a tuft of trichomes. The new species grows in the understory of wet montane forests of the Western Cordillera of Colombia, in the Chocó–Valle del Cauca border area.

RESUMEN. Se describe e ilustra *Burmeistera salicifolia* Garzón, Luteyn & F. González (Campanulaceae-Lobelioideae), una nueva especie de los departamentos del Chocó y Valle del Cauca, Colombia, y se discuten sus afinidades. La nueva especie es una pequeña hierba epífita o terrestre, con corola verde, que se distingue por la lámina foliar angosta con venación broquidódroma, los lóbulos del cáliz cortos, ancho-triangulares, y los lóbulos de la corola subiguales, angostamente ovado-lanceolados, y en ángulo recto con respecto al tubo. *Burmeistera salicifolia* se asigna a *Burmeistera* Triana sect. *Burmeistera*, debido a que el ápice de las anteras ventrales carece de penachos de tricomas barbados. La nueva especie crece en el sotobosque de bosques montanos húmedos de la Cordillera Occidental de Colombia, en los bordes entre los departamentos del Chocó y el Valle del Cauca.

Key words: *Burmeistera*, Campanulaceae, Chocó, cloud forests, Colombia, IUCN Red List, Lobelioideae, Valle del Cauca.

Burmeistera Triana consists of ca. 106 species of herbs to shrubs, sometimes epiphytic or hemiepiphytic plants. Since the description of the genus by Triana (1854), major contributions to its taxonomy have been those by Zahlbruckner (1906, 1915), Gleason (1925), and Wimmer (1931, 1932, 1943, 1953, 1968). Other contributions to the taxonomy of the species of *Burmeistera* mainly from Guatemala, Honduras, Costa Rica, Panama, Ecuador, and Peru were those by McVaugh (1949, 1965), Wilbur (1975, 1976, 1981), Nash (1976), Jeppesen (1981), Stein (1987), Lammers and Maas (1998), and Muchhala and Lammers (2005).

Burmeistera is highly diversified in the Andes of Colombia, where ca. 50% of the species occur; five of these species have been described during the last three decades (Lozano & Galeano, 1986; Luteyn, 1986; Lammers, 1998, 2002). In addition, nine new species have been described (Garzón & González, 2012; Garzón et al., 2012, 2013) as part of the taxonomic revision of the genus for the *Flora of Colombia*, currently underway. After careful examination of type collections, descriptions, and a large number of herbarium specimens (housed mainly at COL, CUVC, and NY), we detected a set of specimens that do not match any of the species previously described. Thus, we describe a new species, as follows.

Burmeistera salicifolia Garzón, Luteyn & F. González, sp. nov. TYPE: Colombia. [Valle del Cauca:] Valle/Chocó border area, El Cairo, correg. Boquerón, vereda Las Amarillas, Serranía de Los Paraguas, ca. 21–25 km beyond El Cairo, ca. 4°45′N, 76°20′W, 1850–2000 m, 25 Apr. 1989 (fl., fr.), *J. L. Luteyn & J. Giraldo 12663* (holotype, CUVC-16770; isotypes, NY [barcode] 01185845, NY [barcode] 01185846). Figures 1, 2.

Species *Burmeisterae xerampelinae* E. Wimm. proxima, sed ab ea foliis anguste ellipticis vel lanceolatis nervatione brochidodroma, pedunculis longioribus (6–8 cm longis), corollae lobis rectis (non falcatibus) usque ad 3.5 cm longis, tubo stamineo breviter exserto, antheris ventralibus ebarbatis atque bacca alba distinguitur.

Terrestrial to epiphytic herb to 50 cm tall, almost pendent, usually unbranched, glabrous, with white

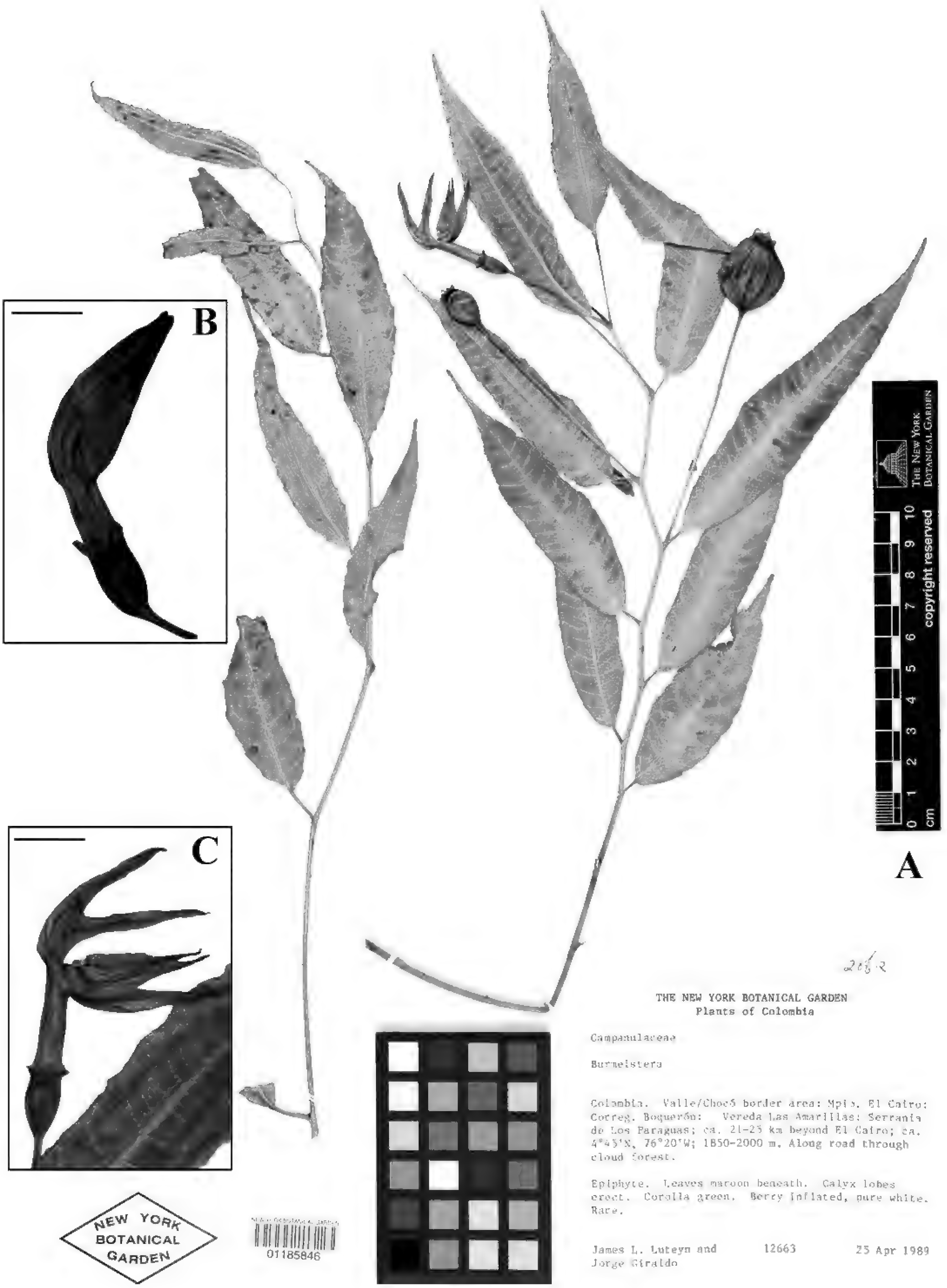


Figure 1. A. Isotype of *Burmeistera salicifolia* Garzón, Luteyn & F. González (*J. L. Luteyn & J. Giraldo 12663*, NY). —B. Detail of a pre-anthetic flower in lateral view. —C. Detail of an anthetic flower in lateral view; note the extremely short calyx lobes and the long, narrowly ovate-lanceolate corolla lobes forming a right angle with respect to the tube. Scale bars in B and C = 1 cm.



Figure 2. Detail of the isotype of *Burmeistera salicifolia* (*J. L. Luteyn & J. Giraldo 12663*, NY). Note the narrowly ovate-lanceolate corolla lobes forming a right angle with the tube in a pre-anthetic flower in the twig at right, and two papery berries in the twig at center.

latex; stems fleshy, reddish to purple, with internodes 4–7.5 cm. Leaves few (to 12) per individual, distichous; petiole 2–9 mm, reddish green to reddish purple; blades narrowly elliptic to lanceolate, (4–) 5.5–13 × 1–2.2 cm, subcoriaceous to coriaceous, discolorous, adaxial surface usually dark green except along the veins, which are light green to occasionally maroon, abaxial surface green to reddish

green when fresh, yellow-green to maroon, base often slightly asymmetric, acute, apex acuminate, acumen to 2 cm, margin serrulate, with 12 to 20 maroon teeth on each side, each tooth ending in a capitate apex, venation brochidodromous, with 12 to 20 pairs of secondary veins, each terminating in a tooth, major secondary veins spaced regularly, excurrent with respect to the midvein. Flowers solitary, in the axils of the distal leaves; peduncle ebracteate, 6–8 cm at anthesis, white to green; hypanthium shortly cylindrical, 8–10 × 6–8 mm, calyx lobes broadly triangular, short, 1–2 × 2–3 mm, separated by a broad (1–2 mm wide) sinus, margin reddish green, entire, erect; corolla glabrous outside, green, tube 1.5–2 cm long, not inflated but distally slightly constricted, 6–7 mm diam. proximally, 4–5 mm diam. distally, corolla lobes subequal, narrowly ovate to lanceolate, not falcate, forming a right angle with the tube at anthesis, apex acute to shortly acuminate and curved inward, dorsal lobes 2.4–3.5 cm × 2–5 mm, lateral lobes 2–2.3 cm × 2–5 mm, ventral lobe 1.8–2.2 cm × 2–5 mm; androecium shortly exserted (ca. 5 mm) between the dorsal lobes, filament tube suberect, to 2 cm long, anther tube curved-cylindrical, to 3 mm diam. at its midpoint, covered with strigose indument, sparsely pubescent to glabrous at its apical margin, dorsal anthers to 6 mm long, ventral anthers to 4 mm long, not barbate; gynoecium with the stigma white. Berry pendent, oblate, inflated, 2.5–3.8 × 4.5–5.8 cm (fresh), pure white, with 10 longitudinal furrows; seeds ovoid to rhomboid, to 1.3 × 0.6 mm.

Distribution and habitat. *Burmeistera salicifolia* has been collected only in two very narrow areas of the Western Cordillera of Colombia (Serranía de los Paraguas and Cerro del Torrá), located between the departments of Chocó and Valle del Cauca. It grows in the understory of sub-Andean cloud forests, between 1600 and 2200 m. The species is locally rare.

IUCN Red List category. *Burmeistera salicifolia* is known from five specimens, all of them collected in or near the type locality in two well-preserved natural reserves (Serranía de los Paraguas and Cerro del Torrá). However, the geographical proximity of these two reserves (ca. 30 km in a straight line), the narrow distribution of the known populations, the local scarcity of the individuals, and the extreme habitat decline around the reserves are sufficient criteria to assess its conservation status and to consider the new species as Endangered (EN), according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Burmeistera salicifolia* has been collected with flowers and fruits in April, and with fruits in August and December.

Etymology. The specific epithet refers to the shape of the leaves, which resemble those of some species of *Salix* L. (Salicaceae).

Discussion. The taxonomic affinities of *Burmeistera salicifolia* are unclear. On one hand, the short calyx lobes and the corolla bent in a right angle between the tube and the lobes resemble those of *B. xerampelina*, a species partially sympatric with the new species in the Western Cordillera; *B. xerampelina* differs by the ovate-oblong to ovate-lanceolate leaves with semi-craspedodromous venation, falcate corolla lobes, barbate ventral anthers, and pink berries, versus narrowly elliptic to narrowly lanceolate leaves with brochidodromous venation, straight corolla lobes, nonbarbate ventral anthers, and pure white berries in *B. salicifolia*. On the other hand, the leaf shape and size of *B. salicifolia* resemble those found in *B. chiriquiensis* Wilbur, *B. darienensis* Wilbur, *B. longifolia* Gleason, and *B. zurquiensis* Wilbur, although the brochidodromous venation of the new species occurs only in *B. darienensis* (Table 1). Furthermore, the latter four species do not overlap geographically with *B. salicifolia*, and three of them (*B. chiriquiensis*, *B. darienensis*, and *B. zurquiensis*) are restricted to southern Central America. These four species differ from *B. salicifolia* by the following differential characters: long (> 6 mm) calyx lobes in *B. chiriquiensis* and *B. zurquiensis* (vs. 1–2 mm in *B. salicifolia*); corolla with an angle of 120° between the tube and the lobes in *B. chiriquiensis*, *B. darienensis*, and *B. longifolia* (vs. an angle of 90° in *B. salicifolia*); and ventral anthers barbate in *B. darienensis* (vs. not barbate in *B. salicifolia*).

Paratypes. COLOMBIA. **Chocó:** San José del Palmar, Cerro del Torrá, vertiente occidental, abajo del helipuerto, vereda de Río Negro, 9 Aug. 1988 (fr.), *J. E. Ramos & P. Silverstone 1095* (CUVC); San José del Palmar, Cerro del Torrá, vertiente oriental, arriba del helipuerto, 8 Aug. 1988 (fr.), *P. Silverstone et al. 4251* (CUVC, NY). **Valle del Cauca:** El Cairo, vereda La Florida, límite entre Valle y Chocó, 9 Dec. 1995 (fr.), *N. Ruiz & G. Lozano 576* (COL); Cordillera Occidental, vertiente oriental, El Cairo, Las Amarillas, cerca de base del Cerro del Inglés, a 1 hora en jeep de El Cairo, serranía de Los Paraguas, 1 Apr. 1988 (fl., fr.), *P. Silverstone et al. 3880* (NY).

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Table 1. Distinguishing characters between *Burmeistera salicifolia* Garzón, Luteyn & F. González and five species from southern Central America or the Colombian Western Cordillera with relevant vegetative or floral similarities.

	B. salicifolia	*B. chiriquiensis* Wilbur	*B. darienensis* Wilbur	*B. longifolia* Gleason	*B. xerampelina* E. Wimm.	*B. zurquiensis* Wilbur
Shape of leaf blade	narrowly elliptic to lanceolate	narrowly linear	narrowly elliptic to lanceolate	lanceolate	ovate-oblong to ovate-lanceolate	lanceolate to ovate-lanceolate
Size of leaf blade (cm)	(4–)5.5–13 × 1–2.2	10–12.5 × 7–10	(9–)12–17 × 3–5	5–9.5 × 2.3–3	5–7 × 1.8–3	5–9.5 × (1.5–)2.5–3.9
Venation	brochidodromous	semi-craspedodromous	brochidodromous	semi-craspedodromous	semi-craspedodromous	semi-craspedodromous
Length of peduncle (cm)	6–8	3	3–5	not known	4–5	2–5
Shape of calyx lobes	broadly triangular	narrowly linear	ovate to oblong	broadly triangular	ovate	lanceolate
Size of calyx lobes (mm)	1–2 × 2–3	7–9 × 0.5–0.8	2–3 × 2	not known	0.6–1.5 × 1–1.5	(6–)8–12 × 1.5–3
Shape of corolla lobes	narrowly ovate to lanceolate, not falcate	broadly oblong, falcate	linear-oblong	oblong-falcate to triangular	falcate	oblong-linear
Angle between corolla lobes and tube	ca. 90°	ca. 120°	ca. 120°	ca. 120°	ca. 90°	not known
Indument of ventral anthers	not barbate	not barbate	barbate	not barbate	barbate	not barbate
Color of mature berry	pure white	not known	not known	not known	pink	not known
Geographical range	Valle del Cauca/Chocó border area, Colombia	Bocas de Toro/Chiriquí, Panamá	Darién, Panamá	northern Antioquia, Colombia	Western and Central cordilleras, Colombia	Heredia, Costa Rica

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Manglietia guangnanica (Magnoliaceae), a New Species from Yunnan, China

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Abstract. *Manglietia guangnanica* D. X. Li & R. Z. Zhou (Magnoliaceae), a new species from Yunnan, China, is described and illustrated. Its pollen morphology, ecology, and conservation status are presented. *Manglietia guangnanica* is closely related to *M. pachyphylla* Hung T. Chang, *M. crassipes* Y. W. Law & *M. fordiana* Oliv. The new species is distinguished from *M. pachyphylla* by its narrower leaves (4–6 cm vs. 6–10 cm), the glabrous abaxial surfaces (vs. pubescent), the shorter peduncles (1.4–1.8 cm vs. 2.3 cm) and pedicels (0.4–0.6 cm vs. 0.7–1.8 cm), the smaller gynoecia (1.7–1.9 cm vs. 2.1–2.9 cm) and fewer carpels (29 to 34 vs. 54 to 61), and fewer ovules (six to eight vs. [eight]nine to 17[18] ovules per carpel). *Manglietia guangnanica* differs from *M. crassipes* by its narrower leaves (4–6 cm vs. 6–9.3 cm), the ovoid gynoecia and flower buds (vs. elliptic), the sparse sericeous indument on the buds, the pale green color of the branchlets and abaxial blade surfaces (vs. these surfaces glaucous), and the fewer carpels (29 to 34 vs. 37 to 40) and ovules (six to eight vs. eight to 13[14] ovules per carpel). The new species also differs from *M. fordiana* by its branches (glabrous except the young nodes that are sparsely pubescent with erect brown trichomes vs. an indument of appressed, rusty brown trichomes), the peduncles, abaxial surfaces of leaves, and bottoms of outer tepals (glabrous vs. appressed, rusty brown trichomes), the petioles (sparsely brown pubescent and later glabrate vs. appressed, rusty brown trichomes), fewer ovules (six to eight vs. eight to 14 ovules per carpel), as well as the longer stigmas and beaks (stigmas 4–5 mm vs. 1–2 mm, beaks 2–4 mm vs. 1–2 mm).

Key words: China, IUCN Red List, Magnoliaceae, *Manglietia*, Yunnan.

The Magnoliaceae are distributed in Asia and the Americas in temperate, tropical, and subtropical habitats. Over 100 species are found in China, with 89 species in Yunnan Province, which suggests this Chinese region as a modern center of distribution and diverse conservation (Law et al., 1995; Law, 1996, 2000, 2004). Within the Magnoliaceae, *Manglietia* Blume is considered to be the most primitive genus (Law, 1984; Xu et al., 2004), because these taxa are all evergreen trees, with flowers that are terminal, anthers that dehisce introrsely, filaments that are very short and flat, and gynoecia that have ovules four or more per carpel.

During fieldwork in Yunnan, D. X. Li and R. Z. Zhou found an interesting *Manglietia*, from which living plants were collected and subsequently cultivated at the Kunming Botanical Garden as well as the South China Botanical Garden. The name was included in the *Magnolias of China* (Law, 2004) but was published without a Latin description. According to Article 36.1 of the International Code for Botanical Nomenclature (McNeill et al., 2006), this name was invalidly published. After several years of careful observations, we conclude that this taxon did not correspond to any described species of *Manglietia* species and, thus, it is validly established here as a new species.

† This article is in honor of our co-author Qing-Wen Zeng (1963–2012), who dedicated his entire life to research on the Magnoliaceae, but unfortunately passed away on 20 September 2012, after falling from the tree *Manglietiastrum sinicum* Y. W. Law (46 m high) while doing fieldwork in a remote area of Xichou County near Fadou Town in Yunnan Province. Prof. Zeng had long been engaged in all aspects of the study of the Magnoliaceae. We will miss him forever.

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Living plants of the new species, *Manglietia guangnanica* D. X. Li & R. Z. Zhou, and of three other species, *M. pachyphylla* Hung T. Chang, *M. crassipes* Y. W. Law, and *M. fordiana* Oliv., were examined in the field. Detailed information for the habitat of *M. guangnanica* and its population size, ecology, distribution, and conservation status were obtained from the records of the original type collection as well as from our continued observations in the field. Morphological comparison was made from our observation in the field and the literature of the Magnoliaceae (Xia et al., 2008).

Samples of mature pollen of *Manglietia guangnanica* were obtained from the collection *X. M. Hu & Q. W. Zeng 00166* (IBSC). For SEM observations, pollen grains were dispersed directly on stubs, gold-coated in a JFC-1600 auto fine coater (JEOL, Tokyo, Japan), and observed under a JEOL JSM-6360 LV SEM operated at 25 kV.

Manglietia guangnanica D. X. Li & R. Z. Zhou, sp. nov. TYPE: China. Yunnan: Guangnan Co., Heizhiguo village & town, Mt. Gulu, limestone montane evergreen broad-leaved forest, 1710 m, 17 Oct. 1993, *R. Z. Zhou & Q. W. Zeng 93049* (holotype, IBSC; isotype, IBSC). Figures 1, 2.

Haec species *Manglietiae pachyphyllae* H. T. Chang, *M. crassipedi* Y. W. Law et *M. fordianae* Oliv. affinis, sed a *M. pachyphylla* foliis abaxialiter glabris, pedunculo pedicellisque brevioribus et gynoeciis minoribus, a *M. crassipedi* ramulis sicut foliis abaxialiter pallide viridibus (non glaucis), gynoeciis alabastrisque ovoideis et alabastrorum indumento sparso sericeo, ab eis ambabus foliis angustioribus et carpellis paucioribus, a *M. fordiana* ramis praeter nodos juvenes, pedunculo sicut foliis abaxialiter et tepalis exterioribus glabris, petiolis parce pubescentibus et stigmatibus rostrisque longioribus, ab omnibus ovulis paucioribus (6 ad 8 in quoque carpello) differt.

Evergreen trees to 15 m, to 50 cm DBH; bark grayish brown; young branches pale green, glabrous, except the nodes sparsely pubescent with brown erect trichomes, glabrate with age; buds with rusty brown or grayish brown sericeous indument. Leaves thick and leathery, narrowly obovate to narrowly elliptic or obovate, 13–26 × 4–6 cm, blade apex contracted acuminate, blade base narrowly cuneate, adaxially green, glabrous, with impressed midrib, abaxially paler green, with midrib elevated; secondary veins 10 to 18 on each side of midrib; higher-order venation reticulate, inconspicuous on both surfaces; petioles 1.6–3 cm long, slightly swollen at base, sparsely brown pubescent, later glabrous, stipular scars 3–4(–8) mm. Flowers bisexual, terminal, solitary and fragrant; flower buds ovoid, peduncles erect, glabrous, 1.4–1.8 × 0.8–0.9 cm, with a single spathaceous brown bract; pedicels 0.4–0.6 cm; tepals 9 to 10, outer 3 tepals pale green, oblong, emarginate, with 7 longitudinal veins externally evident, 4.6–5 × 2.7–3.5 cm, the middle 3 tepals fleshy, white, obovate, briefly acute at apex, 4–4.8 × 3.1–3.4 cm, inner 3 to 4 tepals fleshy, white, obovate, briefly acute at apex, 4.1–4.5 × 2.6–3.1 cm; stamens 224 to 240, purplish red, 1.4–1.8 × 0.2–0.4 cm, anthers introrsely dehiscent, connectives terminated by ca. 1 mm triangular short appendages; scars of stamens along the axis of the torus purplish red, ca. 1.4–0.6 × 0.7 cm; gynoecia ovoid, 1.7–1.9 × 1.2–1.3 cm, carpels 29 to 34, 6- to 8-ovulate in 2 lines per carpel, with 3 to 5 elevated longitudinal ridges externally evident, stigmas 4–5 mm. Aggregate fruit ovoid, 4–5 × 3.5–4.5 cm; follicles densely tuberculate when dry, apex with 2–4 mm beaks that curve outward when mature.

Pollen. SEM observations show that the pollen grains of *Manglietia guangnanica* are bilaterally symmetrical, heteropolar, and monocolpate. The colpus is deep, extends nearly to both poles, and is elliptic in polar view and boat-shaped in equatorial view; lumina can be observed in the exine of pollen grains. According to Walker's standard (1976), the pollen grains of the species are of large size (51.0–77.0 μm in equatorial axis and 24.0–51.0 μm in polar axis). The general shape of pollen grains and the exine ornamentation agree with those of other genera in the family as previously reported (Canright, 1953; Agababian, 1972; Praglowski, 1974; Wei & Wu, 1993; Xu & Wu, 1995; Xu, 1998, 1999, 2002; Lin & Yu, 2003; Xu et al., 2004).

Distribution. *Manglietia guangnanica* is endemic and known to occur only from two localities in Guangnan County in Yunnan Province. The type was collected from Mount Gulu near Heizhiguo village and town. Paratypes, except *X. M. Hu & Q. W. Zeng 00166* (collected from the cultivated tree), were collected from Mount Gulu near Heizhiguo village, Heizhiguo Town, and Mount Houshan near Zhujie village, Zhujie Town, also in Guangnan County. Both mountains are characterized by limestone.

IUCN Red List category. *Manglietia guangnanica* is an excellent ornamental plant for its handsome tree shape and large, fragrant flowers. It is only known from two localities, and populations at both areas are small. So far, less than 100 mature individuals have been found, and very few seedlings and young trees have been observed around the mature individuals. This species should be classified as Critically Endangered (CR), according to IUCN (2001) criteria.



Figure 1. *Manglietia guangnanica* D. X. Li & R. Z. Zhou. —A. Fertile branch. —B. Outermost tepal, adaxial surface. —C. Middle tepal, adaxial surface. —D. Inner tepal, adaxial surface. —E. Adaxial view of stamen. —F. Abaxial view of stamen. —G. Gynoecium with the androecium removed. —H. Uppermost carpel removed from the gynoecium, longitudinal view. —I. Middle carpel, longitudinal view. —J. Lowermost carpel, longitudinal view. —K. Aggregate fruit. Illustration drawn from the holotype *R. Z. Zhou & Q. W. Zeng 93049* (IBSC) and from the paratype *D. X. Li & Z. Q. Ouyang 920512* (MO).

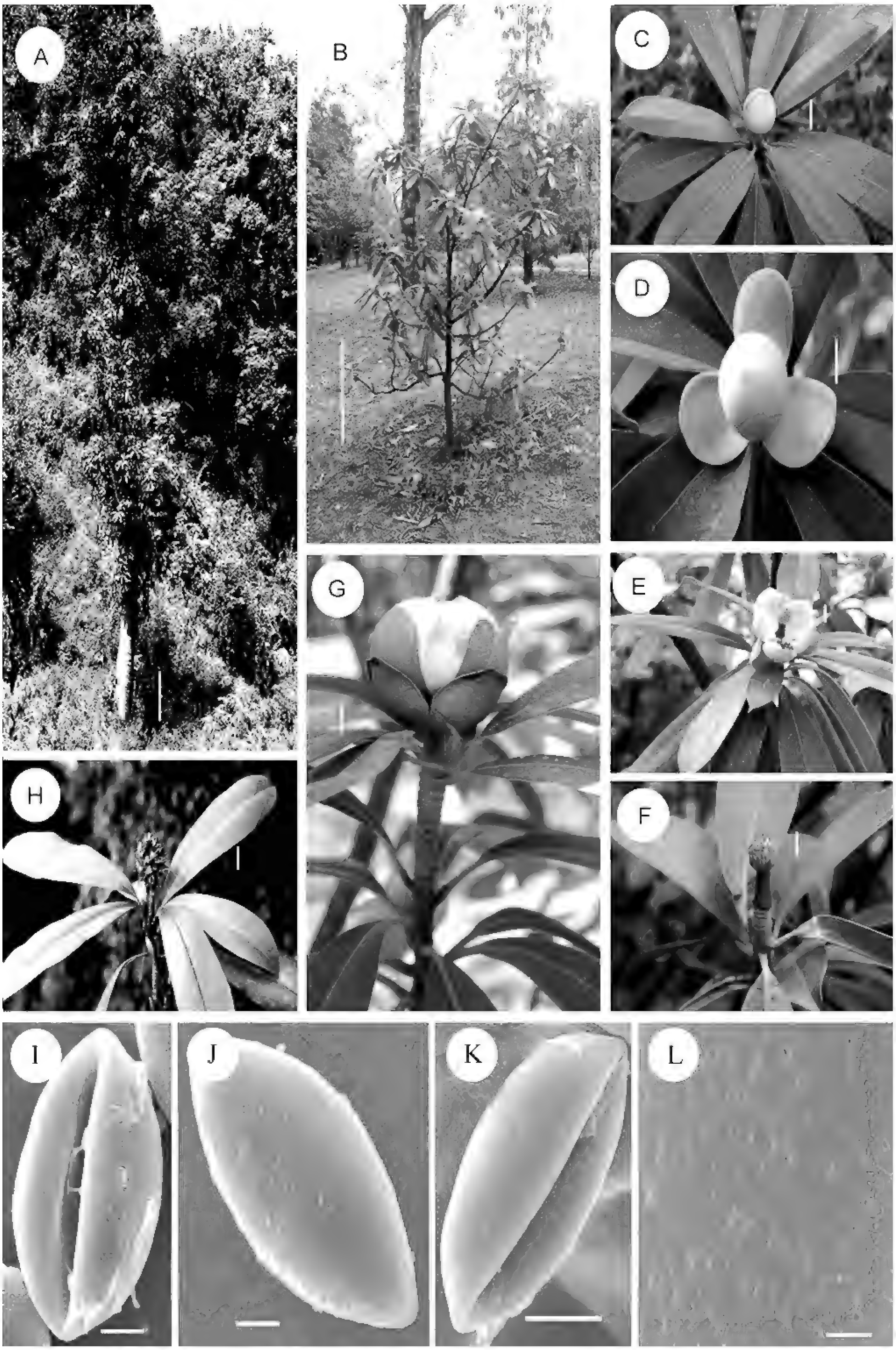


Figure 2. *Manglietia guangnanica* D. X. Li & R. Z. Zhou. —A. Habitat at the holotype locality. —B. Tree in cultivation at Kunming Botanical Garden, Kunming Institute of Botany. —C. Terminal flower bud. —D. Flower in early anthesis, with outer tepals unfolded. —E. Flower in full anthesis. —F. Gynoecium, without tepals. —G. Lateral view of young flower, showing the spathaceous bract. —H. Mature aggregate fruit, revealing the red seeds. Pollen of *M. guangnanica*. —I, K. Equatorial view. —J. Polar view. —L. Detail of exine ornamentation. Scale bars for A = 1 m; B = 0.5 m; C–E, H = 2 cm; F, G = 1 cm; I, J = 10 um; K= 20 um; and L = 2 um. Pollen was obtained from *X. M. Hu & Q. W. Zeng 00166* (IBSC), from a cultivated accession at the Kunming Botanical Garden, Kunming Institute of Botany, Chinese Academy of Sciences.

Phenology and ecology. This species has been collected in flowering from April to May and fruiting from September to October. *Manglietia guangnanica* was noted from limestone mountain localities, from evergreen broad-leaved forests at altitudes from 1600 to 1710 m. Other tree associates include *Castanopsis lamontii* Hance (Fagaceae), *Choerospondias axillaris* (Roxb.) B. L. Burtt & A. W. Hill (Anacardiaceae), and *Phoebe macrocarpa* C. Y. Wu (Lauraceae).

Etymology. The specific epithet *guangnanica* is derived from the county name of the type locality.

Relationships. *Manglietia guangnanica* has close morphological similarity with *M. pachyphylla*, *M. crassipes*, and *M. fordiana*. The new species is distinguished by its young branchlets that are glabrous except at the nodes, which have sparse and erect, brown trichomes (vs. glaucous branchlets or appressed, rusty brown trichomes), by the glabrous abaxial surface of the leaves and peduncles (vs. glaucous, with appressed, rusty brown trichomes), and by the fewer ovules per carpel (six to eight vs. eight to 17). The differences between *M. guangnanica* and *M. fordiana* are significant. *Manglietia guangnanica* is more or less glabrate (with the exception of the buds with their rusty brown or grayish brown sericeous indument, and the nodes of young branchlets that are sparsely pubescent with erect, brown trichomes, and the petioles that are sparsely brown pubescent, later glabrous). In contrast, the buds, branchlets, abaxial surfaces of leaves, petioles, peduncles, and basal portions of the outer tepals of *M. fordiana* are covered with appressed, rusty brown trichomes.

Paratypes. CHINA. **Yunnan Province:** Guangnan Co., Heizhiguo village & town, Mt. Gulu, 1710 m, 12 May 1992, *D. X. Li & Z. Q. Ouyang 920512* (MO), 16 Apr. 2003, *R. Z. Zhou 03046* (IBSC); Zhujie village & town, Mt. Houshan, 1600 m, 4 Oct. 1993, *R. Z. Zhou 9304* (IBSC); Kunming Botanical Garden, Kunming Institute of Botany, Chinese Academy of Sciences, 1 May 2010, *X. M. Hu & Q. W. Zeng 00166* (IBSC).

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Five New Species, One New Name, and Transfers in Neotropical Mistletoes (Loranthaceae), Miscellaneous Notes, 61–68

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Abstract. New combinations are here proposed for *Maracanthus costaricensis* (Kuijt) Kuijt [≡ *Oryctina costaricensis* Kuijt] and *Passovia pedunculata* (Jacq.) Kuijt [≡ *Loranthus pedunculatus* Jacq.]. Five new species of Loranthaceae from South America are also described and illustrated: *Psittacanthus longiflorus* Kuijt from Peru, *Struthanthus cajamarcanus* Kuijt from Peru, *S. ophiostylus* Kuijt from Peru, *S. truncatus* Kuijt from Colombia, and *Tristerix divaricatus* Kuijt from Peru. The name *Passovia pedunculata* is neotypified.

Key words: Colombia, IUCN Red List, Loranthaceae, *Loranthus*, *Maracanthus*, Neotropics, *Oryctina*, *Passovia*, Peru, *Psittacanthus*, *Struthanthus*, *Tristerix*.

As part of ongoing studies on Neotropical Loranthaceae, additional novelties and nomenclatural changes have emerged. New combinations and names are proposed as well as the description of five new species from Colombia and Peru.

61. Transfer of *Oryctina costaricensis* to *Maracanthus*

Maracanthus costaricensis (Kuijt) Kuijt, comb. nov. Basionym: *Oryctina costaricensis* Kuijt, Novon 17(4): 476–478, figs. 1, 2. 2007. TYPE: Costa Rica. Puntarenas: Cantón de Osa, R. F. Golfo Dulce, Peninsula de Osa, Rancho Quemado, Sector Sureste, 8°40′50″N, 83°33′00″W, 250 m, 16 Sep. 1992, *J. Marin & D. Marin 521* (holotype, UC; isotypes, CR not seen, INB not seen, MO).

The Neotropical genera *Maracanthus* Kuijt and *Oryctina* Tiegh. are both characterized by indeterminate inflorescences bearing pairs of bracteolate, sessile, hexamerous flowers (Kuijt, 1976, 1981). Especially in *Oryctina*, the flowers are exceedingly small, and in the recently discovered species *O. atrolineata* Kuijt, the inflorescence is reduced to a single flower (Kuijt, 2003). When *O. costaricensis*, from the Osa Peninsula in Costa Rica, was first described (Kuijt, 2007), it was the only Mesoamerican representative of the genus. A review of the relevant species in *Oryctina* has convinced me that this species was misplaced, and it is now placed in the genus *Maracanthus*.

Oryctina was initially separated from *Oryctanthus* (Griseb.) Eichler by its lack of bracteoles (or prophylls) and its dioecy; however, both these features were subsequently shown to be in error (Kuijt, 1981). Prophyllar bracteoles in *Oryctina* are exceedingly small, as are its floral organs, and at least two species, *Oryctina subaphylla* Rizzini and *O. scabrida* (Eichler) Tiegh., are monoecious. However, especially through subsequently described species (Kuijt, 2000), there is no doubt that *Oryctina* represents a valid genus.

The distinctions between *Oryctina* and *Maracanthus* are based on floral characters. The prophyllar bracteoles of *Oryctina* are minute and have a more or less smooth, rounded dorsal surface; the anthers are sessile and have either two or four locules and no connectival prominence is present. Species that correspond to this are from central Brazil, with the exception of *O. atrolineata* from Guyana. The prophylls in *Maracanthus*, in contrast, are quite prominent, with a distinctive, carinate dorsal surface; the anthers are dorsifixed and borne on evident filaments (although short in *M. badilloi* (G. Ferrari) Kuijt), each bearing a very prominent connectival horn. In two of the known species, *M. chlamydatus* (Rizzini) Kuijt and *M. pedunculatus* Kuijt, functional styles terminate in a distinct, capitate stigma; in the remaining species, *M. badilloi*, the stigma is less evident (cf. Kuijt, 1987, as *M. pusillus* Kuijt). The three species heretofore known are all from Venezuela and Colombia. In *O. costaricensis* the prophyllar bracteoles are large, to 1 mm, and carinate; distinct filaments are present, and the connectival horn, especially of the shorter stamen series, is quite prominent, to 0.5 mm and to lengths equivalent to the anther sacs (Kuijt, 2007: 478, fig. 2b). The Costa Rican species corresponds in these features to *Maracanthus* rather than *Oryctina*, and therefore the proposed new combination *M. costaricensis* is supported. Geographically, the Costa Rican species would seem to be part of the Colombian–Venezuelan group.

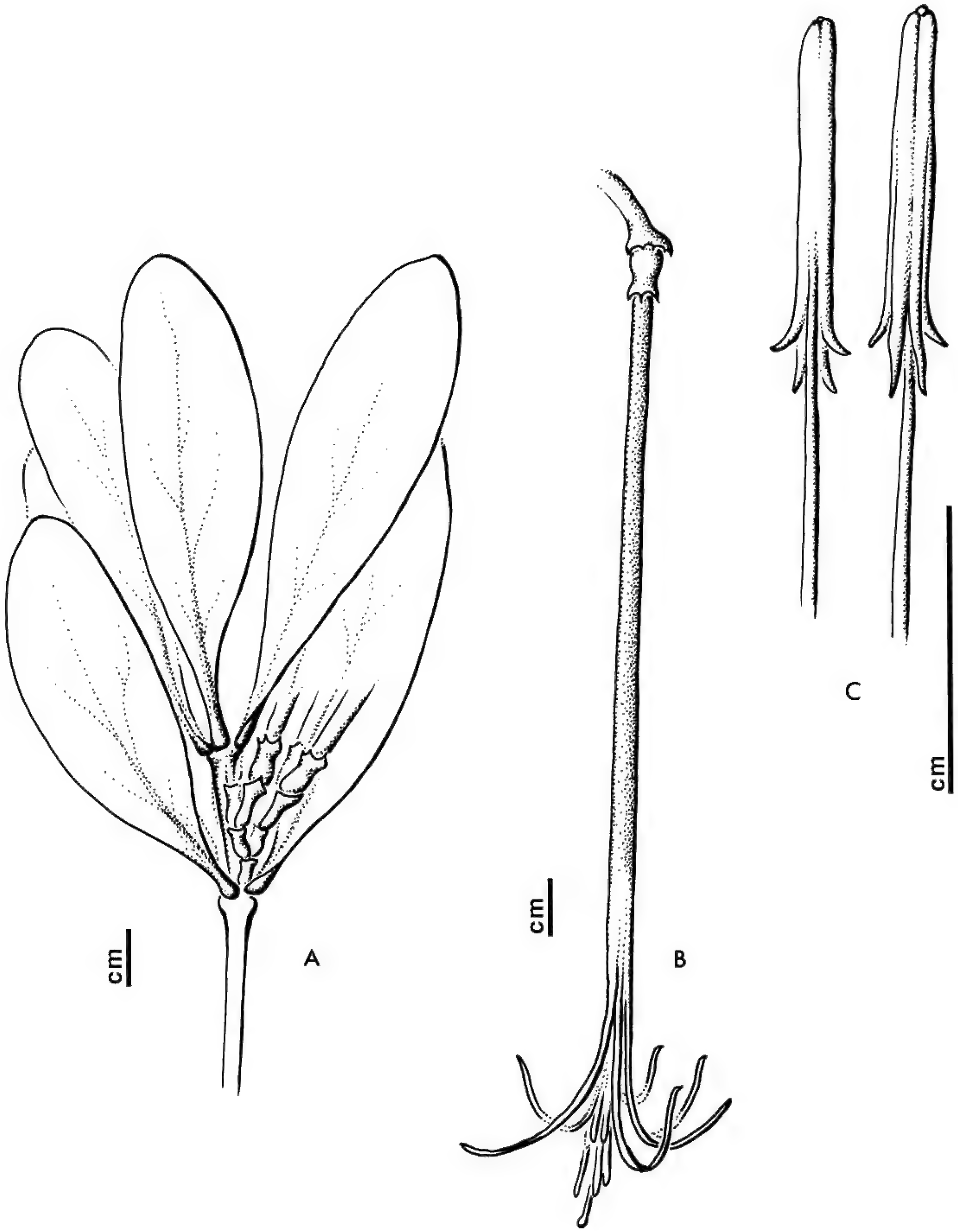


Figure 1. *Psittacanthus longiflorus* Kuijt. —A. Habit. —B. Flower. —C. Anther morphology, seen abaxially (left) and adaxially (right). Drawn from the holotype, *V. Quipuscoa, A. Sagástegui, S. Leiva & M. Bejarano 1322* (NY).

62. A New Name for *Passovia stelis*

Passovia pedunculata (Jacq.) Kuijt, comb. nov.

Basionym: *Loranthus pedunculatus* Jacq., Enum. Syst. Pl. 18. 1760. TYPE: Panama. Panamá: Arraijan, seaside W of Vera Cruz, sea level, 30 May 1978, *B. Hammel 3298* (neotype, designated here, MO; isoneotype, UC).

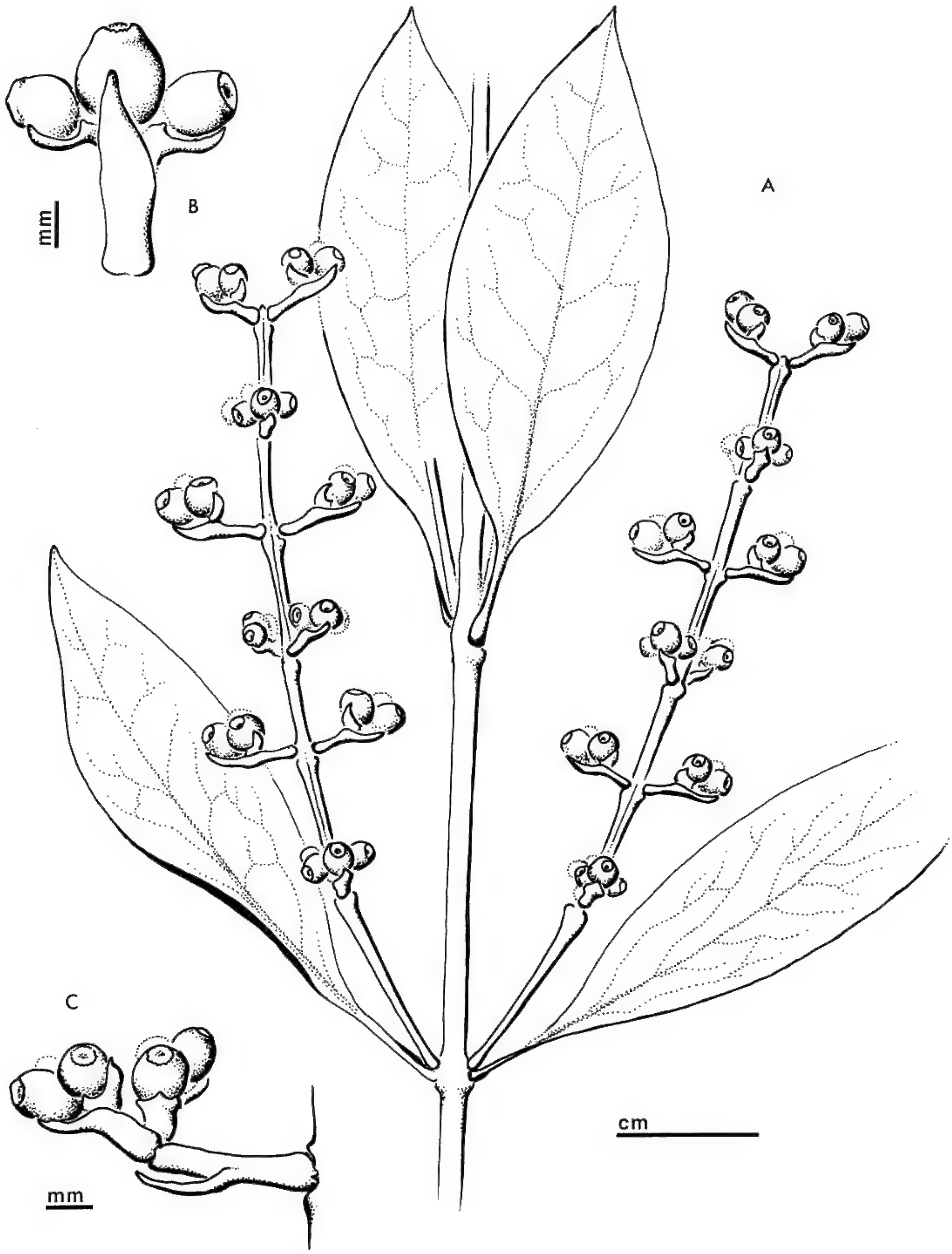


Figure 2. *Struthanthus cajamarcanus* Kuijt. —A. Habit of fruiting plant. —B. Triad, seen abaxially. —C. Lateral inflorescence unit with two triads on lower inflorescence. Drawn from the holotype, *C. Díaz, S. Flores & W. Córdova 10695* (UC).

Loranthus sessilis Jacq., Enum. Syst. Pl. 18. 1760, nom. inval., syn. nov.

Phthirusa amazonensis Weir, Dept. Bull. U.S.D.A. 1380: 95. 1926, syn. nov. TYPE: Brazil, Rio Beni, Riberalta, 30 Sep. 1923, *J. R. Weir s.n.* (holotype, US-1199133; isotype, US-1199134).

Passovia stelis (L.) Kuijt, Pl. Div. Evol. 129(2): 205–206. 2011, syn. nov. Basionym: *Loranthus stelis* L., Sp. Pl.,

ed 2. 437. 1762, non *Loranthus stelis* G. Forst., Fl. Ins. Austral. 25. 1786. *Phthirusa stelis* (L.) Kuijt, Taxon 43(2): 193. 1994. TYPE: Corresponds to the type of *Passovia pedunculata* (Jacq.) Kuijt, neotype designated in Kuijt & Kellogg (1996: 50). (cf. Kuijt & Kellogg [1996] for complete synonymy.)

Passovia jamaicensis (Krug & Urb.) Kuijt, Smithsonian Contr. Bot. 98: 479. 2012, syn. nov. Basionym: *Phthirusa jamaicensis* Krug & Urb., Bot. Jahrb. Syst. 24: 15. 1897. TYPE: Jamaica, s.d., *Purdie s.n.* (holotype, K).

After altogether too many changes in the nomenclature of what most recently has been called *Passovia stelis*, a hopefully final change is mandated by the International Code of Botanical Nomenclature (McNeill et al., 2012). It appears that there are two more taxon names in Jacquin's (1760) *Enumeratio* that are indistinguishable from and predate the appearance of *Loranthus stelis* L. by two years, *L. pedunculatus* and *L. sessilis*. For both, as in the historical literature, the diagnosis is exceedingly short. The only difference indicated by Jacquin is that the flowers (presumably triads) were pedunculate (in *L. pedunculatus*) or sessile (in *L. sessilis*), representing a variable feature in the species. A more detailed description was provided three years later (Jacquin, 1763) in which the collection locality of both names was stated to be in the area of Cartago, Venezuela. The only common, triadic, more or less racemose, small-flowered member of Loranthaceae along the Venezuelan coast is what is presently known as *P. stelis*. The question whether either (or both) of Jacquin's species correspond to the most common coastal Venezuelan species can be resolved technically only through the study of their type specimens. But that is precisely the problem, as it has been virtually impossible to locate and authenticate Jacquin's specimens (D'Arcy, 1970). Several of the comments in Jacquin's treatment (1763: 98–99) tend to confirm this identity, especially when mentioning "Filamenta sunt duplo petalis breviora" and "... ramos ... radiculas emittunt crassas teretesque ...," which are conditions found locally only in *Passovia* H. Karst. Both names, *L. pedunculatus* and *L. sessilis*, are here regarded as belonging to the same variable species, thus there remains the task of selecting a neotype. In order to simplify the situation as much as possible, I herewith designate the type of *L. stelis* (MO neotype, *Hammel 3298*) as the type of both of the other species.

63. New Synonyms within *Passovia*

Passovia pyrifolia (Kunth) Tiegh., Bull. Soc. Bot. France 42: 172. 1895. Basionym: *Loranthus pyrifolius* Kunth, Nov. Gen. Sp. Pl. (quarto ed.) 3: 441. 1818 [1820]. *Struthanthus pyrifolius* (Kunth) G. Don, Gen. Hist. 3: 413. 1834. *Phthirusa pyrifolia* (Kunth) Eichler, Fl. Bras. 5(2): 63, tab. 17. 1868. TYPE: [Venezuela.] "Crescit in calidis Prov. Popayanensis, prope Cartago," Fl. Oct., *A. Bonpland s.n.* (holotype, P).

Phthirusa lepidobotrys (Griseb.) Eichler, Fl. Bras. (Martius) 5(2): 334. 1866, syn. nov. Basyonym: *Loranthus lepidobotrys* Griseb., Fl. Brit. W.I. [Grisebach] 311. 1860. TYPE: Jamaica, 1850, *R. C. Alexander s.n.* (holotype, GOET-005495; isotype, K-567886).

Phthirusa brasiliensis Weir, Dept. Bull. U.S.D.A. 1380: 95–96. 1926, syn. nov. TYPE: Brazil. Amazonas: Urucurituba, Madeira River, on *Hevea brasiliensis*, 28 Aug. 1923, *J. R. Weir s.n.* (holotype, US-119132).

Phthirusa lepidobotrys has in the past been regarded as a Jamaican endemic but appears to be no different from the common continental populations of *P. pyrifolia*. The type of *P. brasiliensis* has hitherto escaped my attention but corresponds to the same species.

64. *Psittacanthus longiflorus*, a New Species from Peru

Psittacanthus longiflorus Kuijt, sp. nov. TYPE: Peru. Amazonas: Prov. Chachapoyas, Distr. Leymebamba, a 2 km de la Laguna de los Cóndores, ruta hacia Leymebamba, borde de camino, 2700–2950 m, 18 Aug. 1998 (fl.), *V. Quipuscoa, A. Sagástegui, S. Leiva & M. Bejarano 1322* (holotype, NY; isotypes, F, UC). Figure 1.

Diagnosis. *Psittacanthus longiflorus* is distinguished from all its congeners by the length of its flowers (to 17 cm), its coarsely dentate calyculus, and its conspicuously spurred pollen sacs.

Shoots determinate, each innovation to 5 cm and terminating in a whorl of 3 leaves, the apex aborting; stem internodes slightly 3-angled when young, becoming terete in age. Leaf blade to 9 × 2.5 cm, narrowly elliptical to nearly oblong, apex rounded, base acutely tapering into petiole, ca. 7 mm; venation pinnate; lower midrib prominently raised. Inflorescence a double dyad; inflorescence peduncle 5 mm; dyad peduncle 4 mm; floral pedicel 6 mm; cupule 4 mm wide, with acute apex; flowers to 17 cm, of which the ovary is 6 mm, with coarsely dentate calyculus; corolla tube reflexed; stamens 2 cm, the base attached 3 cm below the petal apex; anthers dorsifixed, at 2 non-overlapping heights, each 9 mm, the apex rounded, the base of the pollen sacs conspicuously spurred, acute, the inner spurs nearly

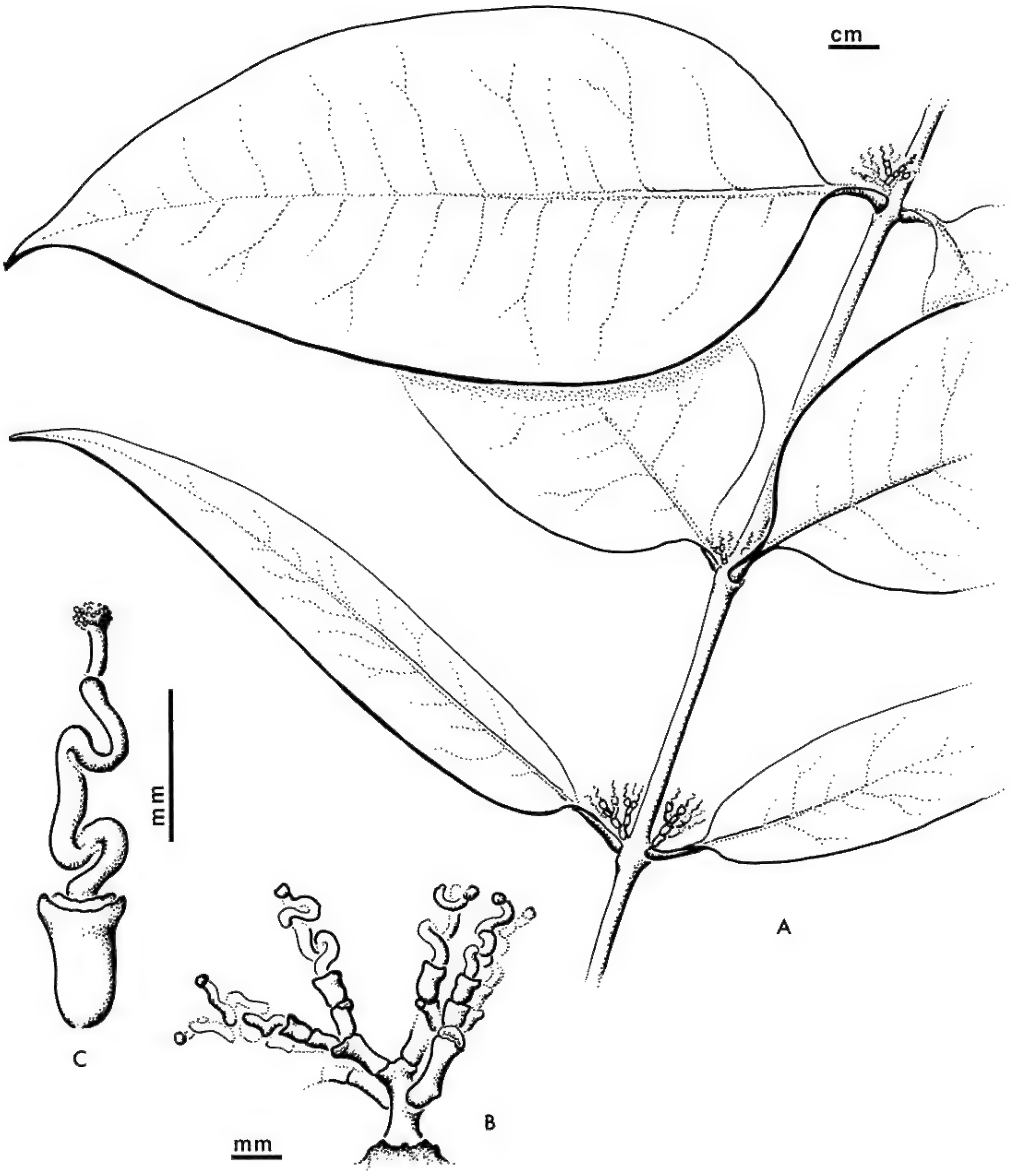


Figure 3. *Struthanthus ophiostylus* Kuijt. —A. Habit. —B. Inflorescence, post-anthesis. —C. Individual flower, enlarged. Drawn from the holotype, *G. Klug 1562* (US).

2 mm; filament attached dorsally just above the anther base; style nearly as long as the petals; stigma clavate. Fruit unknown.

Distribution and ecology. *Psittacanthus longiflorus* is known only from Peru, Amazonas.

IUCN Red List category. Since the new species is known from a single collection, its conservation status is assessed as Data Deficient (DD), according to IUCN (2001) standards.

Discussion. *Psittacanthus longiflorus* may be confused with *Aetanthus macranthus* (Hook.) Kuijt because of its unusually long flowers (to 17 cm), the longest known for *Psittacanthus* Mart., but its dorsifixed anthers in two non-overlapping series as well as the rounded, non-acicular, anther apices

place it in *Psittacanthus*. The species is unique within its genus because of its remarkable flower length as well as its conspicuously spurred anther bases. The length of the flower certainly indicates its pendent natural position as well as its pollination by hummingbirds.

65. *Struthanthus cajamarcanus*, a New Species from Peru

Struthanthus cajamarcanus Kuijt, sp. nov. TYPE: Peru. Cajamarca: San Ignacio, San José de Lourdes, El Crucero, 1000–1100 m, bosque intervenido, 9 June 1999 (fr.), *C. Díaz, S. Flores & W. Córdova 10695* (holotype, UC; isotype, MO). Figure 2.

Diagnosis. *Struthanthus cajamarcanus* differs from all its congeners by the compound structure of its lowest inflorescence units and the marginally dentate bracteoles, and from most by the sharply acute leaf apex and the pedunculate triads placed at right angles to the inflorescence axis.

Glabrous, rigid plants; dioecious; stem internodes 2.5–3.5 cm, terete, smooth, without lenticels; epicortical roots apparently lacking. Leaf blade to 6 × 3.5 cm, lanceolate, apex acute, with needle-like tip, base obtuse to acute, margin smooth and leathery; petiole to 1 cm, discrete; venation pinnate, the midvein running into the apex and keeled on the abaxial surface. Inflorescences 1 per leaf axil, to 6.5 cm; axis quadrangular, unbranched, except for the lowest lateral units, beyond which 4 to 6 pairs of triads extend; lowest 2 lateral inflorescence units composed of a 4-mm-long stalk usually bearing an acicular bract midway and 2 regular triads at the apex (3 or 4 triads in vigorous inflorescences); triad peduncles 3 mm, placed at right angles on inflorescence axis; each bract and bracteole 1.5–2 mm, distinct, acute, acicular in the bract; flowers not seen. Fruit 4 × 3.5 mm, ellipsoid, green; calyculus inconspicuous; bracteoles conspicuous, with marginal tooth near the base.

Distribution and ecology. *Struthanthus cajamarcanus* is known only from the type locality in Cajamarca, Peru.

IUCN Red List category. Since the new species is known from a single collection, its conservation status is assessed as Data Deficient (DD), according to IUCN (2001) standards.

Discussion. Given that no flowers are available in the type specimen, it is presently impossible to be certain whether this remarkable plant belongs to *Struthanthus* or *Passovia*. If the new species turns out to have bisexual flowers, it must be placed in the latter. However, the similarities of *S. cajamarcanus* to *S. marginatus* (Desr.) Blume, from eastern and southern Brazil, strongly suggest that the present taxonomic placement is correct. Nonetheless, *S. marginatus* is a more robust species with sinuous, long stems that bear epicortical roots and does not have the curious basal inflorescence units of *S. cajamarcanus*. It should be noted that *S. marginatus* f. *paniculata* Eichler does occasionally form complex branched inflorescences (Eichler, 1868, fig. 22).

66. *Struthanthus ophiostylus*, a New Species from Peru

Struthanthus ophiostylus Kuijt, sp. nov. TYPE. Peru. Loreto: Mishuyacu, near Iquitos, 100 m, May–June 1930 (fl.), *G. Klug 1562* (holotype, US). Figure 3.

Diagnosis. *Struthanthus ophiostylus* is distinguished from its congeners by its unusually large leaves (to 16 × 8 cm), and especially by its short inflorescence bearing only 4 pedunculate triads; within South American *Struthanthus* it is distinguished from all other species by its conspicuously contorted styles.

Plants robust, sparsely branched, glabrous; stem internodes 5–7 cm × 3 mm, when leaf-bearing, straight, terete. Leaf blade to 16 × 8 cm, lanceolate, apex acute, somewhat attenuate, base obtuse to truncate; petiole 1 cm, distinct; venation pinnate, the midrib strongly marked and flanked by nearly perpendicular lateral veins; adaxial surface shiny. Inflorescences axillary, 1 or several per leaf axil, each ca. 8 mm, indeterminate, consisting of 2 pairs of triads; inflorescence and triad peduncles and floral pedicels (of both lateral and median flowers) 1–1.5 mm, terete; bracts and bracteoles caducous; base of inflorescence subtended by brown, corky crater; ovary as long as floral pedicel; ± cylindrical. Flower with the calyculus smooth; petals and stamens not known; style 2 mm, strongly coiled; stigma capitate, papillate, distinct. Fruit unknown.

Distribution and ecology. *Struthanthus ophiostylus* is known only from the type collection from Loreto, Peru.

IUCN Red List category. Since the new species is known from a single collection, its conservation status is assessed as Data Deficient (DD), according to IUCN (2001) standards.

Discussion. *Struthanthus ophiostylus* appears to be a rare species, as it has not, as far as I know, been collected again since 1930. It is unmistakable

because of its combination of very large leaves and small inflorescences and especially its greatly convoluted (strongly coiled) styles. Such styles are now known from two genera in South American Loranthaceae, *Peristethium* Tiegh. (Kuijt, 2012) and *Struthanthus*. The former genus is characterized by determinate inflorescences, perhaps always at least some monads, and particularly by the chaffy bracts that subtend young inflorescences. None of these features are present in the new species, warranting its assignment to *Struthanthus*. In Mexico, some species of *Struthanthus* and *Cladocolea* Tiegh. also show similar stylar convolutions (Kuijt, 1975a, 1975b). There, as well as in South America, the biological significance of coiled styles is a mystery. It should be noted that the styles do not straighten out, but are dropped in the coiled condition after anthesis. Stylar convolutions in all these cases are always most strongly expressed in the female flower, and the type of *S. ophiostylus* is likely to be male.

67. *Struthanthus truncatus*, a New Species from Colombia

Struthanthus truncatus Kuijt, sp. nov. TYPE: Colombia. Chocó: Río Atrato near Río Sucio, seasonally inundated swamp, less than 100 m, 16 Jan. 1974 (fl.) *A. Gentry 9258* (holotype, MO-2464246; isotype, UC). Figure 4.

Diagnosis. Large, sparsely branched plants reminiscent of *Struthanthus orbicularis* (Kunth) Eichler, differing from it by the broadly obovate leaves with truncate apex and a small, recurved apiculus, and the sessile anthers with a small connectival horn at apex.

Plants glabrous, scandent, dioecious, with epicortical roots emerging from the stems and probably from the base; stem internodes to 7 cm, terete, smooth, lacking lenticels. Leaf blade up to 5(–5.5) × 4.5–5(–5.5) cm, broadly obovate, apex truncate, with minute, abaxially reflexed apiculus, base acute to nearly obtuse; petiole to 1 cm, distinct; venation pinnate; midrib evident, raised, running into the apex. Male inflorescence at least 5 cm; axis strongly quadrangular; peduncle to 5 mm, followed by at least 5 pairs of nearly sessile triads with broad, caducous bracts and minute, acute bracteoles. Flowers greenish cream; male flower buds 6 mm, clavate, sessile, hexamerous; petals narrow and pointed, 5 mm; calyculus irregularly dentate; anthers sessile, ellipsoid, with prominent connectival horn, placed at 2 overlapping heights; sterile style slender, 4 mm; stigma undifferentiated; ovary 1 mm. Female plants and fruit unknown.

Distribution and ecology. *Struthanthus truncatus* is known from the type locality, from the Chocó region in Colombia. The species may also have been collected from the departments of Cauca and Putumayo.

IUCN Red List category. Since the new species is reliably known from a single collection, its conservation status is assessed as Data Deficient (DD), according to IUCN (2001) standards.

Discussion. The remarkable leaf shape clearly distinguishes *Struthanthus truncatus* as a distinct species. Moreover, the sessile anthers in this new taxon also represent an exceedingly unusual feature in the genus. *Struthanthus truncatus* seems to be related to *S. orbicularis*, which is a large and common species ranging from southern Mexico to the Bolivian Amazon. *Struthanthus orbicularis* has much larger inflorescences, a different leaf shape, quadrangular internodes, evident filaments on the non-sessile stamens, and the young leaves function as prehensile organs (Kuijt, 1964).

Two more specimens from Colombia are listed below as possible paratypes. They present, at least sometimes, a similar leaf shape, but are much larger plants, thus I cannot be certain whether they are conspecific with the new taxon. The first one from Cauca has inflorescences at least 15 cm long, bearing at least eight pairs of (female) flowers, with triads on peduncles 2.5 mm long, and all flowers on pedicels 3.5 mm long. The second (male) specimen from Putumayo bears even larger leaves, the blades being up to 9 × 6 cm, and having an apex, at least sometimes with a distinct 2-mm-long tooth; its inflorescences reach at least 12 cm in length and bear up to 13 pairs of triads; both flowers and triads are completely sessile.

Paratypes. COLOMBIA. **Cauca:** Quebrada across Río Naya from El Plastico, inundated streamside, 3°10′N, 77°22′W, 20 m, 23 Feb. 1983 (♀ fl.), *A. Gentry & A. Juncosa 40600* (MO). **Putumayo:** Mocoa y los alrededores al Norte, 750–850 m, 3–7 Dec. 1942 (♂ fl.), *R. E. Schultes & C. E. Smith 2056* (MO).

68. *Tristerix divaricatus*, a New Species from Peru

Tristerix divaricatus Kuijt, sp. nov. TYPE. Peru. Cajamarca: San Ignacio, San José de Lourdes, slopes of Cerro Picorana, 4°58′S, 78°53′1″W, 2500–2540 m, 5 Dec. 1998 (fl., fr.), *J. Campos, L. Zurita & M. Camizan 5944* (holotype, UC; isotype, MO). Figure 5.

Diagnosis. *Tristerix divaricatus* is reminiscent of *T. longibracteatus* (Desr.) Barlow & Wiens, but differs from it primarily by its lax, racemose inflorescence with spreading rather than erect, clustered flowers and its

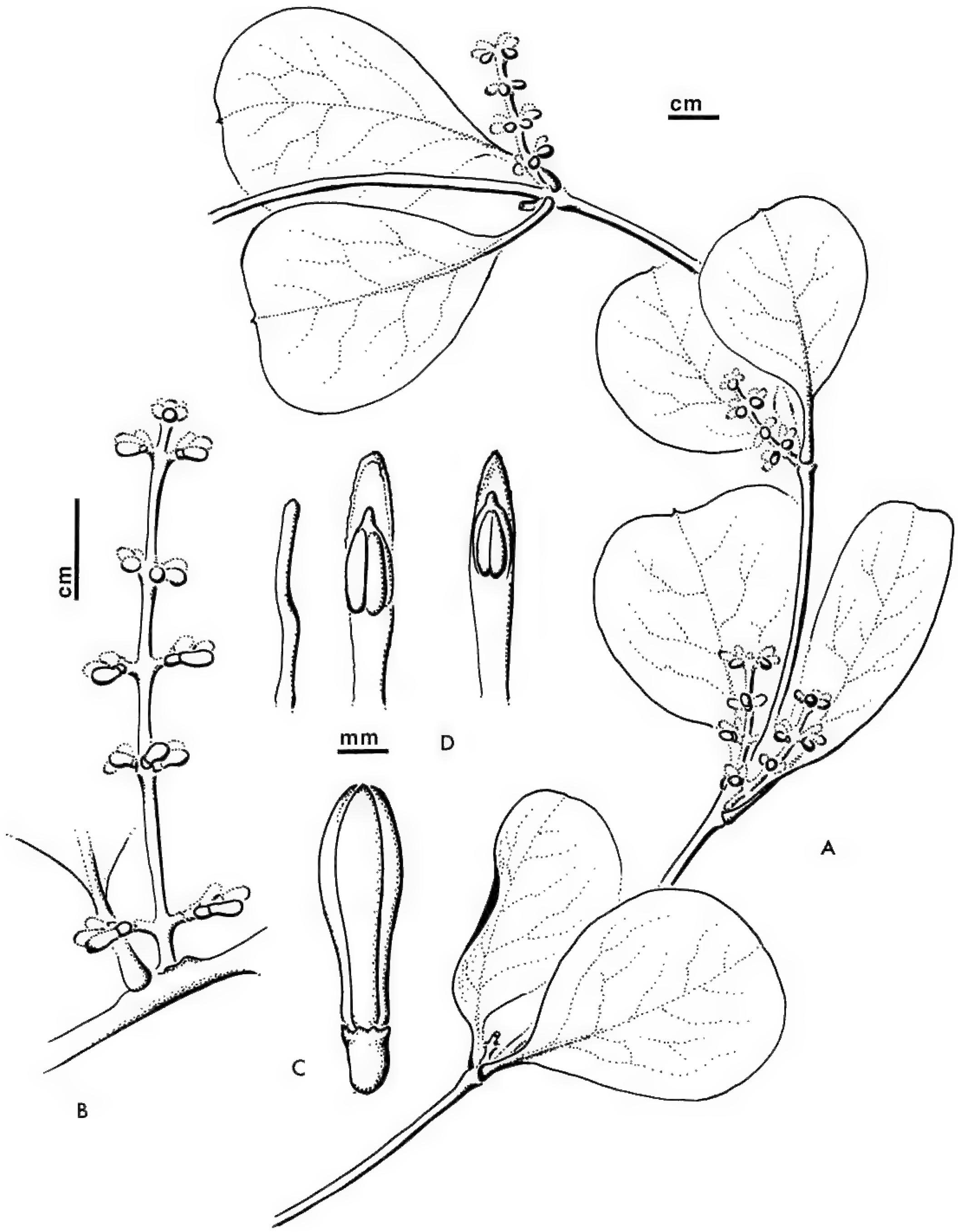


Figure 4. *Struthanthus truncatus* Kuijt. —A. Habit, with young inflorescences. —B. Inflorescence. —C. Male flower bud. —D. Style and two stamen-petal complexes, seen adaxially. Drawn from the isotype, *A. Gentry 9258* (UC).

long pedicels, and also by its much smaller fruit lacking the apical, conical prominence characteristic of *T. longibracteatus*.

Plants sympodial, glabrous; stem internodes 2–5 cm, keeled to somewhat quadrangular. Leaves to 5 × 2.5 cm, broadly lanceolate, the apex acute; venation pinnate, the lower midrib keeled. Inflorescence terminal, racemose, bearing 6 to 8 flowers, in pairs or in whorls of 4; floral pedicel 1 cm; floral bract 10–20 × 4–5 mm, lanceolate, cuneate and acute; flower

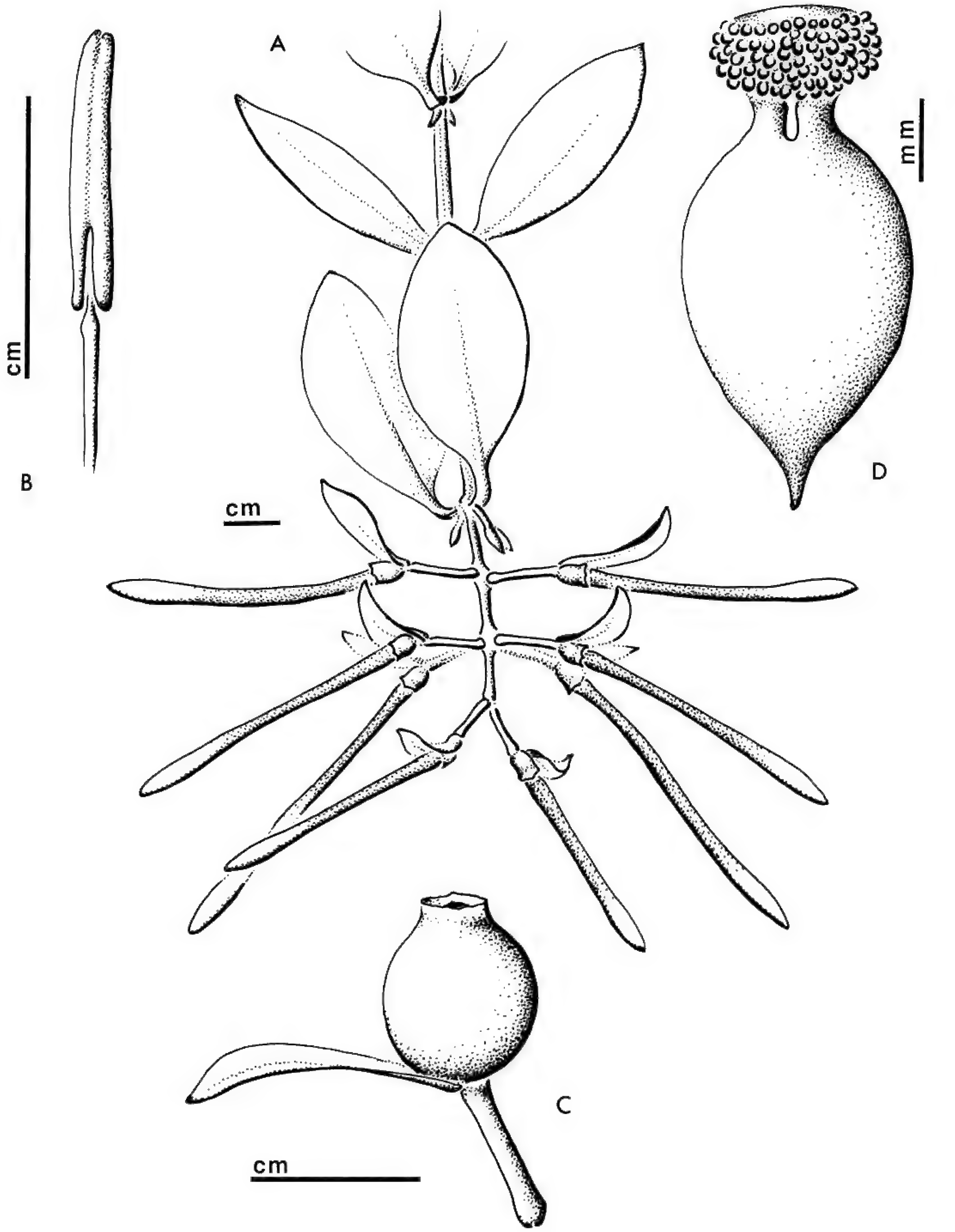


Figure 5. *Tristerix divaricatus* Kuijt. —A. Habit. —B. Stamen, seen adaxially. —C. Fruit, pedicel, and foliar bract. —D. Embryo, showing fused cotyledonary blades (below) and haustorial disk with papilla (above). Drawn from the holotype, *J. Campos, L. Zurita & M. Camizan 5944* (UC).

buds to 7 cm, 3 mm thick below, the terminal 1.5 cm expanded to 4 mm, apex tapered but ultimately rounded. Flowers erect, with the calyculus shallowly dentate; petals 5; stamens nearly isomorphic; filaments 17 mm; anthers 10 mm, with filament attachment in a deep dorsal groove, 3 mm from the anther base; ovary 4 × 4 mm, ± straight; style straight; stigma weakly differentiated, slightly

notched and very finely papillate. Fruit 9 × 9 mm, globular, the calyculus slightly dentate.

Distribution and ecology. *Tristerix divaricatus* is known only from the type locality in Cajamarca, Peru.

IUCN Red List category. Since the new species is known from a single collection, its conservation status is assessed as Data Deficient (DD), according to IUCN (2001) standards.

Discussion. The extremely open and extended inflorescence of *Tristerix divaricatus* gives this species a distinctive aspect that has no counterpart elsewhere in the genus. Nevertheless, there is little doubt that it is closely related to *T. longibracteatus* and *T. peytonii* Kuijt. *Tristerix divaricatus* differs most strikingly from *T. longibracteatus* in its inflorescence, both in the elongation of the main axis and in the length of the individual floral pedicels, but also in having keeled or quadrangular internodes, globular fruits that lack the conical prominence characteristic of *T. longibracteatus* fruits, and a much more prominent calyculus (Kuijt, 1988, fig. 10c). The flowers of *T. longibracteatus* stand more or less erect (cf. Kuijt, 1986, fig. 10a), while those of *T. divaricatus* are perpendicular to the inflorescence axis. *Tristerix peytonii* differs from the new species in having longer (up to 8 cm), distinctly arched buds, the ovary twice as long as broad, and the bud apex showing a distinct, slight petal dimorphism (Kuijt, 1988, fig. 9b). In contrast, *T. divaricatus* has buds to 7 cm long and more or less straight, an equidimensional ovary, and no petal dimorphism at the bud apex. The collection localities of the two species are about 1200 km apart, with *T. peytonii* being a narrow endemic of the Cuzco area in Peru.

The mature embryo of *Tristerix divaricatus* is 6 mm long and closely resembles that of *T. longibracteatus* (cf. Kuijt, 1982, fig. 47). The radicular pole consists of a broad haustorial cushion with a smooth face and the sides densely covered by innumerable, prominent papillae. In contrast to that of *T. longibracteatus*, the papillar haustorial cushion is set off sharply from the attached cotyledonary petioles. Otherwise as generally occurring in the genus, the blades of the cotyledons themselves are completely fused without showing a suture and terminate into an acute tip. The cotyledonary petioles remain separate, with the eventual first leaves emerging in between them; thus, the germination pattern is cryptocotylar. The embryo is surrounded by a relatively small amount of endosperm, from which the haustorial cushion emerges. The massive, fused cotyledons appear to have taken over much of the storage function of the endosperm, a developmental trait, which ultimately, in an independent, parallel fashion, has resulted in the complete loss of endosperm in other Loranthaceae such as *Aetanthus* (Eichler) Engl. and *Psittacanthus* (Kuijt, 2009).

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Three New Species of *Mendoncia* (Acanthaceae) from Madagascar

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Abstract. Three species of *Mendoncia* Vell. ex Vand. (Acanthaceae) are newly recognized from Madagascar: *M. decaryi* (Benoist) E. Magnaghi, *M. delphina* E. Magnaghi, and *M. kely* E. Magnaghi. Each is based on a unique suite of morphological characters, and all are endemic to Madagascar. A key to the six species of the genus known from Madagascar is provided. A lectotype is designated for *M. cowanii* (S. Moore) Benoist var. *decaryi* Benoist.

Key words: Acanthaceae, IUCN Red List, Madagascar, *Mendoncia*.

Mendoncia Vell. ex Vand. consists of about 80 species occurring worldwide, but species are concentrated in the Neotropics. Some 70 species occur in moist to wet forests of the New World, from southeastern Mexico to Bolivia and Brazil, with the greatest number of species (35 to 40) recorded from Colombia. Species in the Old World occur throughout tropical Africa, from Liberia east to Kenya, and on the islands of Madagascar and Mayotte. To date, there has been no recent comprehensive taxonomic account for the entire genus.

Mendoncia is included in the Acanthaceae subfamily Thunbergioideae, where it is sister to *Thunbergia* Retz. and *Pseudocalyx* Radlk. (Scotland & Vollesen, 2000; Borg et al., 2008; McDade et al., 2008). The genus is distinguished from other Acanthaceae by the combination of its twining habit, enlarged and paired bracteoles subtending the flowers, highly reduced calyx, 5-brevicolpate and spherical pollen, and 1-seeded, drupaceous fruits.

Three species of *Mendoncia* have been reported from Madagascar: *M. cowanii* (S. Moore) Benoist, *M. flagellaris* (Baker) Benoist, and *M. vinciflora* Benoist. *Mendoncia cowanii* is endemic to the wet tropical forests of eastern Madagascar, and *M. vinciflora* is restricted to the wet montane forests in the north of the island. *Mendoncia flagellaris* occurs in wet tropical forests throughout Madagascar and also on the island of Mayotte, in the Comoro Archipelago. Benoist (1944, 1967) recognized three varieties of *M. cowanii*: variety *cowanii*, variety *coursii* Benoist, and variety *decaryi* Benoist. Recent taxonomic studies of *Mendoncia* in Madagascar and Africa (Magnaghi, 2010), which included many more collections than were known to Benoist, have revealed the necessity for changes in the status of *M. cowanii* var. *decaryi* (which is herein elevated to species status) and the existence of two new species, which we describe below.

The three species newly treated here occur in northern, eastern, and southern Madagascar and are endemic to the island. Each exhibits a unique combination of features that distinguishes it from other Paleotropical members of the genus. Because each of these species is currently known from relatively few localities in the northern and eastern wet-evergreen forests of Madagascar that have suffered extensive deforestation, we summarize information useful toward assessing the conservation status of each, based on IUCN Red List categories, criteria, and guidelines (IUCN, 2013). Google Earth Pro (Google Inc., 2013) was used to plot the collections known for each species and to estimate their extent of occurrence (EOO) and area of occupancy (AOO; grid size 4 km^2). Inadequacies in our knowledge of these species, and thus possible sources of error in our assessments, include our understanding (1) that although the major herbaria with holdings of Malagasy plant collections have been consulted, the distributional data obtained from those sources are not necessarily complete; (2) that our knowledge of habitats is based primarily on information provided on herbarium specimen labels, which is often scanty and can result in imprecise comparisons of habitats; and (3) that no counts or estimates of numbers of mature individuals at a site are available. Our attempts to estimate numbers of individuals for other species of Malagasy *Mendoncia* (e.g., *M. cowanii* and *M. flagellaris*) were complicated by the twining habit of these plants and by their inconspicuousness, except in the forest canopy. Considerable loss of habitat through time due to human activities in the lowland and montane, wet-evergreen forests of northern and eastern Madagascar has been well documented (e.g., Preston-Mafham, 1991). If these forests are treated as a single location (IUCN, 2013: 41 guidelines define location as a "geographically or

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ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present"), then species will receive a higher threat category than they would if the forests were treated as multiple locations. Although the IUCN (2013) guidelines do not define their use of the word *rapidly*, from an example provided therein the threat from gradual loss and degradation of habitat in these forests would not qualify them as a single location. Indeed, for each of the three species of *Mendoncia*, some collection sites occur in areas receiving habitat protection while others do not. Those sites receiving habitat protection could not be considered part of the same location as the sites without protection under the IUCN (2013) guidelines. Based on the distributional data (including whether some subset[s] of the plants occur in protected lands), we propose a provisional conservation assessment for each taxon.

KEY TO SPECIES OF *MENDONCIA* IN MADAGASCAR

1a. Stigma subcapitate (unlobed or lobes not evident); style 3–10 mm; drupes glabrous, flowers white (usually with purple markings in throat) ..... *M. flagellaris*
1b. Stigma subequally 2-lobed, lobes 0.2–0.8 mm; style 11–33 mm; drupes glabrous or pubescent; flowers white (usually with purple markings in throat) to pink to purple.
  2a. Bracteoles glabrous to sparsely pubescent; calyx glabrous; drupes glabrous.
    3a. Leaves glabrous; drupes oblong to ellipsoid; flowers white with purple in throat ..... *M. delphina*
    3b. Leaves evenly and sparsely to densely pubescent; drupes spherical; flowers violet-purple .... *M. vinciflora*
  2b. Bracteoles densely pubescent, calyx glabrous or pubescent, drupes pubescent.
    4a. Leaves mostly broadly elliptic (length/width 1.4–1.7); corollas 13–19 mm, tube 10–14 mm; style 9–10 mm; drupes ovoid to spherical ..... *M. kely*
    4b. Leaves mostly elliptic (length/width 1.7–2.8); corollas 24–49 mm, tube 20–39 mm; style 15–32 mm; drupes ovoid to subellipsoid.
      5a. Corollas white with lavender at mouth, limb 21–32 mm diam., upper lip 13–14 mm with lobes 8–10 × 11–13 mm, lower lip 16–19 mm with lobes 9–14 × 12–15 mm ..... *M. decaryi*
      5b. Corollas pink to dark pink, limb 6–20 mm diam., upper lip 1.8–9 mm with lobes 1.8–7 × 4–9 mm, lower lip 3–12 mm with lobes 2.2–8 × 3.4–9 mm ..... *M. cowanii*

1. Mendoncia decaryi (Benoist) E. Magnaghi, comb. et stat. nov. Basionym: *Mendoncia cowanii* (S. Moore) Benoist var. *decaryi* Benoist, Notul. Syst. (Paris) 11: 141. 1944. TYPE: Madagascar. Toamasina: Zahamena (réserve no. 3), 23 Mar. 1941 (fl., fr.), *R. Decary 16712* (lectotype, designated here, P 00091101). Figure 1.

Woody vines; young stems quadrate to quadrate-sulcate, evenly and densely to sparsely pubescent with golden-brown antrorse eglandular multicellular trichomes 1.8–3 mm, sometimes pubescent with unicellular short trichomes 0.2–0.3 mm underlying longer flexuous trichomes 1.8–3 mm. Leaves petiolate, petioles to 15 mm, blades mostly elliptic (length/width 1.8–2.6), but sometimes varying to broadly elliptic or subobovate, 28–123 × 24–77 mm, rounded to cordate at base, acute to acuminate at apex, abaxial surfaces bearing entangled multicellular flexuous trichomes 2.6–4.2 mm, sometimes with an understory of shorter trichomes as well, sometimes with tufts of woolly trichomes forming domatia in axils of major veins, adaxial surfaces pubescent with antrorse eglandular multicellular trichomes 0.6–3 mm (hirsute to villous), trichomes often more dense on major veins, margin ciliate. Inflorescence of 1 to 3 flowers in leaf axils, flowers alternate or opposite at nodes, pedunculate, peduncles to 20 mm, pubescent-like stems; bracteoles ovate to elliptic to broadly elliptic, 11–30 × 9–18 mm, long acuminate to subapiculate at apex, acumen/apicule 2.5–4.5 mm, abaxial surfaces densely pubescent with eglandular trichomes 1.8–3.5 mm, adaxial surfaces mealy-glandular, margins of the pair connate from base to two thirds of the way toward the apex during anthesis. Calyx consisting of a rigid, entire, undulating annular or cupular ring surrounding nectar disc, 1.4–3 mm high, densely pubescent with eglandular trichomes 2–3 mm; corolla white with lavender at the mouth, 33.5–49 mm, tube 20–32.5 mm, apically ampliate, limb 20.6–32.4 mm diam., upper lip 13.5 mm with rounded or emarginate lobes 8–10 × 11.2–13.2 mm, lower lip 16.5–19 mm with rounded or emarginate lobes 9.4–13.5 × 12.2–15.2 mm; stamens 6.3–11 mm, inserted near the middle of corolla tube, ventral pair inserted 3.8 mm distal to the dorsal pair, thecae 4.4–6.4 mm, densely pubescent at base with a tuft of stout eglandular trichomes 0.16–0.36 mm, sometimes ventral pair with dense pubescence along length of thecae, connective projecting 0.5–0.7 mm beyond apex of thecae, attenuate; pollen not seen; style 15.3–28 mm, trichomes on lower half of style 0.3–1 mm, stigma subequally 2-lobed, lobes 0.2–0.5 mm. Drupe dark purple to black, subellipsoid, 12.5–20 × 6.5–17 mm, pubescent with golden brown eglandular trichomes 0.6–1 mm.

Distribution and habitat. *Mendoncia decaryi* (Benoist) E. Magnaghi is endemic to northern and eastern-central Madagascar (former provinces Ant-

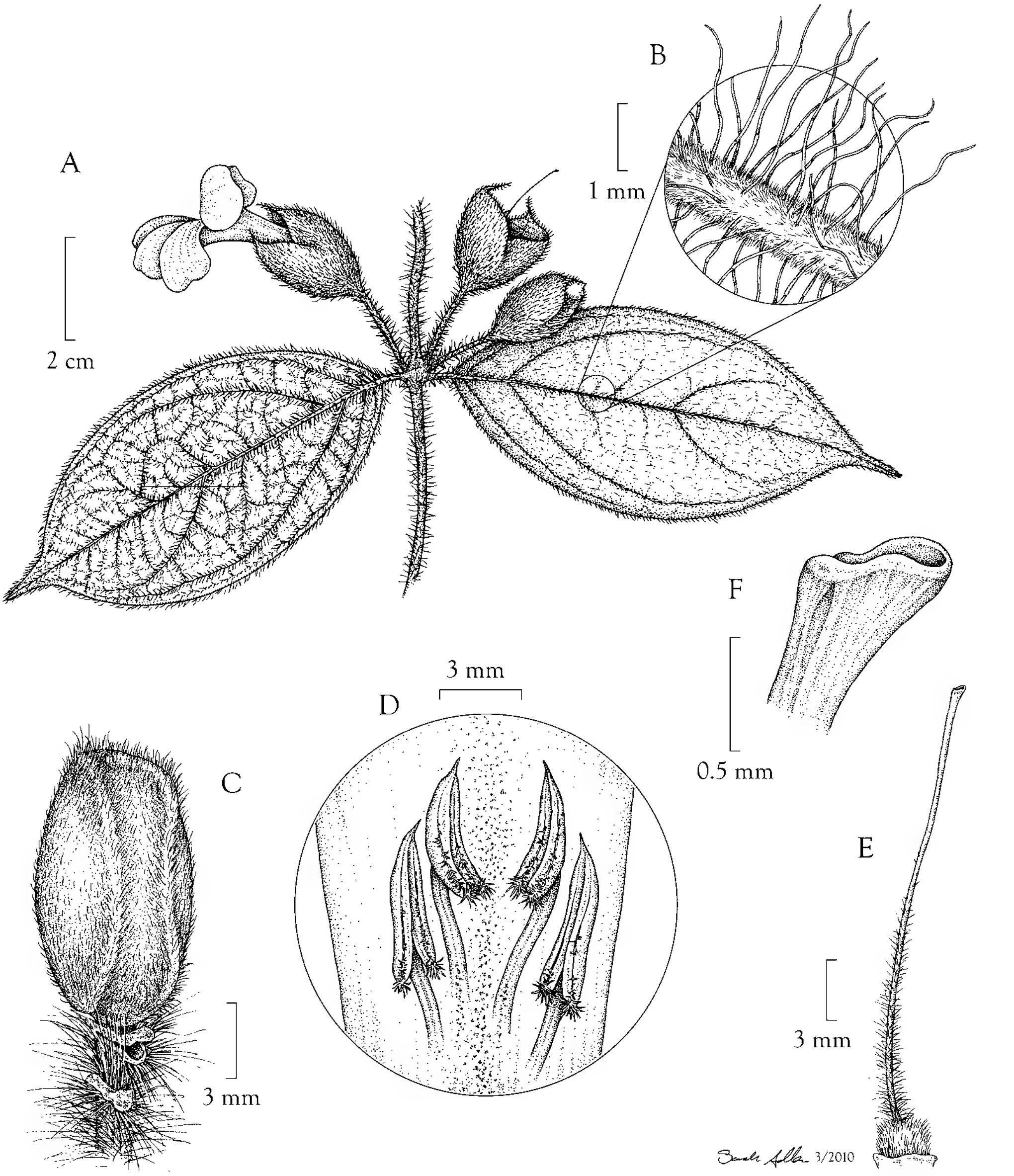


Figure 1. *Mendoncia decaryi* (Benoist) E. Magnaghi. —A. Habit. —B. Close-up of trichomes on adaxial leaf surface. —C. Drupe. —D. Androecium on dissected corolla tube. —E. Calyx and gynoecium. —F. Stigma. A, B, and F from *J. Miller 4202* (MO), with flowers from *D. Du Puy & Du Puy MB 163* (K); C from *J. Razafitsalama 473* (MO); D from *Du Puy & Du Puy MB 163*; E from the lectotype *Decary 16712*.

siranana and Toamasina) where plants occur in primary lowland to montane, wet-evergreen forest at elevations between 300 and 1400 m.

IUCN Red List category and conservation data. At least 17 collections from a minimum of 14 sites are known for *Mendoncia decaryi*. The population (total distributional range) has an EOO of 19,447 km^2. It can be divided into two disjunct subpopulations separated by ca. 275 km, a northern subpopulation with an EOO of 1355 km^2 and a southern subpopulation with an EOO of 489 km^2. The AOO consists of 52 km^2. Based on the EOO, this species would be considered Vulnerable (VU) under IUCN criterion B1, and based on the AOO it would be considered Endangered (EN) under IUCN criterion B2, in each case if appropriate knowledge of subcriterion b or c were available. Two of the sites for this species in the northern subpopulation

occur in the Marojejy Nature Reserve, and at least three in the southern subpopulation occur in the Zahamena National Park. Because of deforestation in this region of Madagascar in combination with the reduced threat to *M. decaryi* afforded by its partial occurrence in two protected areas, we propose a provisional assessment of Vulnerable (VU) for the species.

Phenology. Plants of *Mendoncia decaryi* have been collected in flower from February through April; fruiting collections have been made from March through September.

Etymology. The epithet is taken from the name of Benoist's variety, *Mendoncia cowanii* var. *decaryi*, in honor of Raymond Decary, who collected the type.

Discussion. Benoist (1944, 1967) distinguished *Mendoncia cowanii* var. *decaryi* from the nominate variety by its slightly larger leaves (7–9 × 3.5–5 cm vs. 4–8 × 2–4.5 cm) and longer and denser trichomes (specific measurements not provided). Based on several other morphological characters, *M. cowanii* var. *decaryi* is here elevated to specific rank as *M. decaryi*. The primary characters that distinguish it from *M. cowanii* are summarized in the key above. More subtle characters include cauline pubescence, venation relief, and texture of the leaves. Trichomes on the young stems tend to be more conspicuous and longer (up to 3 mm vs. up to 2 mm) in *M. decaryi* than in *M. cowanii* var. *cowanii*, and trichomes on the abaxial surfaces of bracteoles and leaf blades are erect to flexuose and do not obscure the surface (vs. densely wooly and obscuring the surface of bracteoles in *M. cowanii* var. *coursii*). In *M. decaryi* the first- through fourth-order foliar veins are all prominently raised and visible; in *M. cowanii*, the first- and second-order veins are prominently raised and visible, but the subsequent orders are much less so. The leaf texture of *M. decaryi* appears to be more brittle, and the leaves are thinner than in *M. cowanii*, which tends to have thicker and more coriaceous leaves. The geographic distribution of *M. decaryi* is restricted to the east-central part of the island in and near the Zahamena National Park, near Lac Aloatra, and in the north and near the Marojejy National Park. It partially overlaps that of *M. cowanii*, which is widespread in wet-evergreen forests in northern and eastern Madagascar.

In the protologue of *Mendoncia cowanii* var. *decaryi*, Benoist (1944) cited three collections of Decary (*16712*, *16741*, *16924*) but did not designate a specimen of any of them as the type. From among these collections at P (where Benoist worked), the specimen designated above as lectotype agrees best with the protologue and has the most intact flowering and vegetative material.

Representative specimens examined. MADAGASCAR. **Antsiranana:** N of Maroantsetra, ca. 8 km E of Sahavary, Andranofotsy River, *Du Puy & Du Puy MB 163* (K); Andapa, Doany, Betsomanga, NW du Marojejy, 0.2 km N du camp I, *Gautier et al. 3798* (K, G, MO); Rés. Nat. Marojejy, N slopes of Ambatosoratra, *Miller 4202* (MO, TAN); Andapa, Ambodiangezoka, Antanambe, forêt de Betaolana, à 8.5 km NW d'Ambodiangezoka, Rivière Ambolokopatrika, Camp. I, *Rakotomalaza & Ravelonarivo PJ1956* (G); Andranotsarabe, Befingotra, Bealampona, Andapa, *Rasoavimbahoaka & Rastefanonirina 287* (BR, MO, TAN); SW d'Andapa, Rés. Spéc. Anjanaharibe–Sud. Ambodisatrana, *Ravelonarivo 145* (MO). **Toamasina:** rés. nat. 3 (Zahamena), *Decary 16741* (P 00091100, K 000393674, photo); Betampona, rés. nat. 1, *Decary 16924* (P, TAN 000438, photo); Majunga, 9.6 km NW of Ambohitsaratelo-Bebao (NW of Tsiroanomandidy), *Dorr 3538* (MO, TAN); Ampitanonoka à Fotsialanana, près du Lac Alaotra, *Herb. Station Agricole du L. Alaotra 2441* (MO); W of Vavatenina, Rés. Nat. Intégrale Zahamena, forest of Amboditamenaka, *Malcomber et al. 2516* (MO, TAN); Bongolava W de Tsiroanomandidy, *Morat 4776* (P); Vavatenina, Miarinarivo, Fokontany Anamborano, limite entre Vavatenina et Toamasina II, à 500 m d'Ifasina, *Rakotondrafara et al. 238* (MO); RNI Tamatave, *Rakotoniana 2875* (P); Parc Nat. Zahamena, Andranofantsona, Manakambahiny I, Ambodimangavalo, *Ratovoson et al. 273* (MO); Vavatenina, Ambodimangavalo, sect. 2, environs Parc Azhamena, forêt Ambinanin Antsahabesahona, vers 16 km SE d'Ambarifotsy, Rivière Ihofika, *Razafitsalama 473* (MO).

2. Mendoncia delphina E. Magnaghi, sp. nov. TYPE: Madagascar. Toliara: NW of Taolagnaro (Ft. Dauphin), réserve intégral no. 11 (Andohahela), parcelle I, E boundary, 24°45′S, 46°51′E, 250–500 m, 17–20 Oct. 1992 (fl.), *S. Malcomber, H. van der Werff, B. Gray, S. Raparanivo & B. Randriamanpionona 1665* (holotype, MO 05003406; isotype, K, not seen, TAN, not seen). Figures 2, 3B–D, F.

Diagnosis. *Mendoncia delphina* E. Magnaghi differs from *M. vinciflora* Benoist by its glabrous (vs. pubescent) leaves, oblong to ellipsoid (vs. spherical) drupes, and white corollas with purple markings (vs. violet-purple).

Woody vines; young stems quadrate to quadrate-sulcate, internodes glabrous, nodes often pubescent with sparse trichomes 0.2–0.5 mm. Leaves petiolate, petioles to 14 mm, blades elliptic (length/width 2.1–3.2), 44–83 × 15–34 mm, caudate to acuminate at apex, acute to cuneate at base, surfaces glabrous. Inflorescence of 1 to 2 flowers in leaf axils, flowers alternate or opposite at nodes, pedunculate, peduncles to 40 mm, glabrous to pubescent with sparse golden brown, appressed trichomes 0.2–0.5 mm;

bracteoles ovate to elliptic, 6.9–14 × 5.3–8.3 mm, acute at apex, rounded at base, abaxial surface glabrous or with a few eglandular trichomes to 0.1 mm, adaxial surface mealy glandular, woolly at apex, margins connate from base to 2/3 of the way toward apex; calyx consisting of a rigid, entire, undulating annular or cupular ring surrounding nectar disc, to 1.4 mm high, glabrous; corolla purple to white with purple throat, 16.1–18.5 mm, tube 7.6–9.3 mm, apically ampliate, limb 14–18 mm in diam., upper lip 7.2–9.1 mm with rounded lobes 5.3–6.6 × 4.5–5.8 mm, lower lip 8.5–9.5 mm with rounded lobes 5–8.5 × 3.5–5.7 mm; stamens 8.5–8.8 mm, inserted near the middle of corolla tube, ventral pair inserted 0.5 mm distal to dorsal pair, thecae 4–4.3 mm, densely pubescent at base with a tuft of stout eglandular trichomes 0.1–0.2 mm, connective projecting 0.9–1 mm beyond apex of thecae; pollen 5-brevicolpate; style 12–12.3 mm, stigma subequally 2-lobed, lobes 0.3–0.8 mm. Drupe (possibly immature) ovate-elliptic, 13.7 mm, 8.5 mm diam., glabrous.

Distribution and habitat. *Mendoncia delphina* is endemic to extreme southeastern Madagascar (former province of Toliara) where plants occur in lowland, wet-evergreen forests near Taolagnaro (Fort Dauphin) at elevations between 250 and 500 m.

IUCN Red List category and conservation data. *Mendoncia delphina* is known only from two sites ca. 26 km apart. In order to calculate an approximate EOO, a 1-km² grid was centered on each site, and these two grids were linked at their outermost (eastern and western) corners to calculate a total EOO of ca. 32 km². The AOO is 8 km². Based on either the EOO or the AOO, this species would be considered Critically Endangered (CR) under IUCN criterion B1 or B2 if appropriate knowledge of subcriteria b or c were available. The northernmost of the two known collection sites for this species occurs in the Andohahela National Park. The other collection site occurs outside of the present boundaries of the park and is undoubtedly at greater risk of habitat loss, as noted above. Based on these data, we propose a provisional assessment of Endangered (EN) for *M. delphina*.

Phenology. Plants of *Mendoncia delphina* have been collected in flower in October and November; a fruiting collection was made in November.

Etymology. The epithet derives from the Latin *delphinus* (dolphin), referring primarily to the shape of the leaves, which have a beaked apex and loosely resemble a dolphin, and secondarily from the locality of the type specimen, near Taolagnaro (Fort Dauphin).

Discussion. *Mendoncia delphina* is distinguished from other Malagasy *Mendoncia* by a combination of floral features, geographic distribution, and phenology. The corolla resembles that of *M. flagellaris* in color (white with purple markings in the throat), but the stigma is subequally 2-lobed as in *M. cowanii*. Flowering occurs in October and November, which contrasts with *M. cowanii* (February to April) but is similar to that of *M. flagellaris* (October to February). The distribution of *M. delphina* overlaps that of both *M. cowanii* and *M. flagellaris* but appears to be restricted to southern Madagascar.

Pollen of relatively few species of *Mendoncia* have been studied to date. Pollen of both *M. delphina* and *M. kely* E. Magnaghi were available for study, and we examined unacetolyzed grains from samples of each using SEM (Fig. 3). Like that reported for other species (e.g., Raj, 1961; Muller et al., 1989; Daniel, 1998), pollen of these species is spherical, 5-aperturate, brevicolpate, and rugulate over the interapertural surface. Endoapertures, which are usually not visible in SEM preparations of *Mendoncia* and were not evident in our preparations of these species, possibly accompany each colpus. Although 5-aperturate pollen appears to be common among *Mendoncia* in both the Old World and the New World, grains with three to six apertures have been reported for the genus (e.g., Muller et al., 1989). Pollen of *M. delphina* appears to differ from that of *M. kely* by having microverrucate (vs. smooth) rugulae (Fig. 3E, F).

Paratype. MADAGASCAR. **Toliara:** Préfecture de Ft. Dauphin, Forêt Manantantely, *N. Dumetz 1395* (MO).

3. Mendoncia kely E. Magnaghi, sp. nov. TYPE: Madagascar. Antsiranana: contreforts occidentaux du massif de Marojejy (NE) près du col de Doanyanala (limite des bassins de la Lokoho et de l'Andraronga), N d'Andapa, 800–1200 m, forêt ombrophile sur latérite de gneiss, 25 Jan.–25 Feb. 1949 (fl.), *J.-H. Humbert 23067* (holotype, P 00493688; isotypes, K, MO). Figures 3A, E, 4.

Diagnosis. *Mendoncia kely* E. Magnaghi differs from *M. cowanii* (S. Moore) Benoist by its mostly smaller and broadly elliptic (vs. mostly elliptic) leaves, shorter (4–15.6 vs. 16–28 mm) bracteoles, and shorter (13–19 vs. 24–40 mm) corollas.

Woody vine; young stems quadrate to quadrate-sulcate, densely and evenly pubescent with light

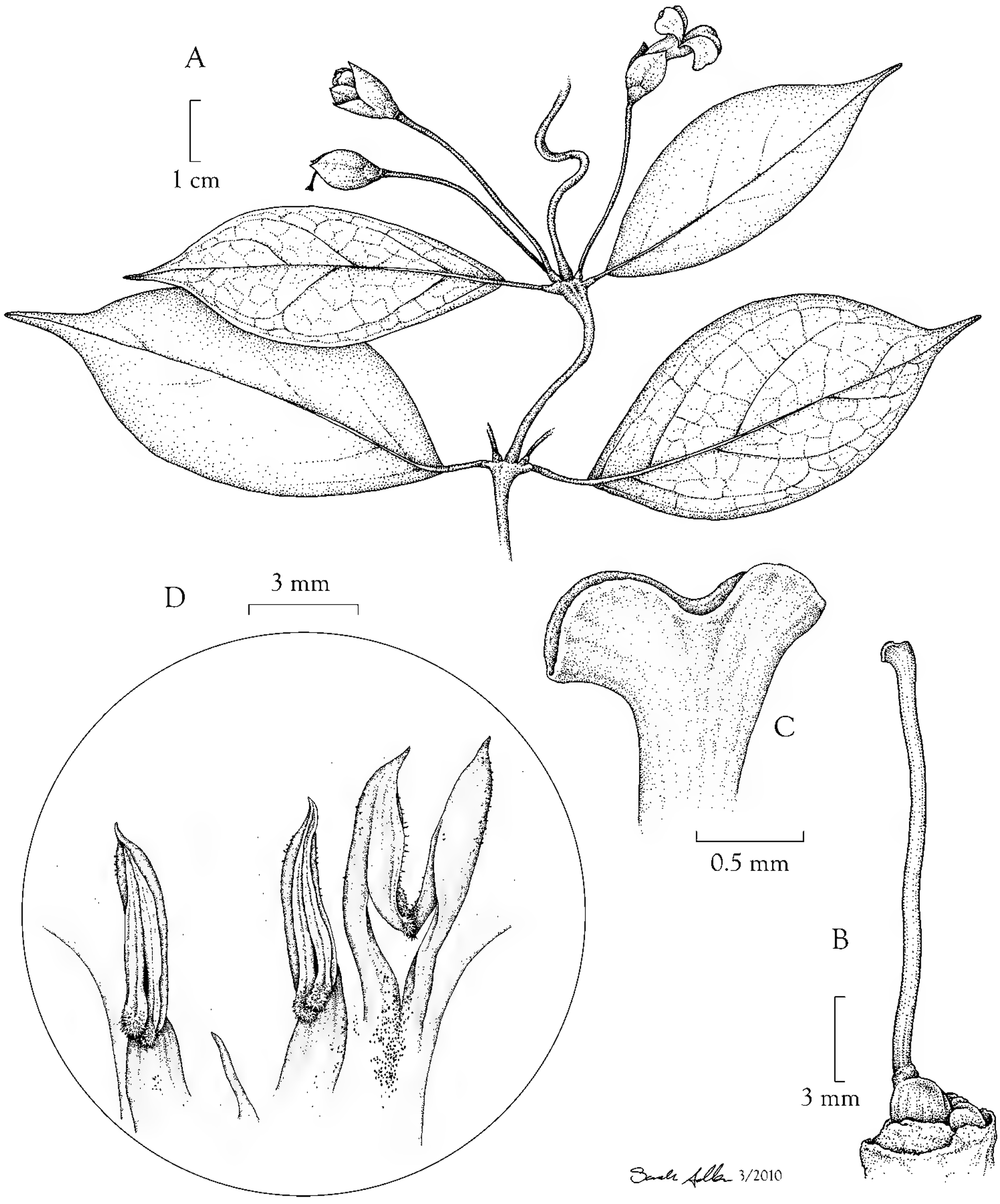


Figure 2. *Mendoncia delphina* E. Magnaghi. —A. Habit. —B. Calyx, nectary, and gynoecium (partially submerged in nectary). —C. Close-up of stigma. —D. Androecium on dissected corolla tube; note staminode lacking anther. A–D from the type *S. Malcomber et al. 1665* (K, MO).

brown to golden retrorse to erect eglandular trichomes 0.2–0.7 mm. Leaves petiolate, petioles to 18 mm, blades mostly broadly elliptic (length/width 1.4–1.7), but sometimes varying from broadly ovate to elliptic, 26–75 × 18–45 mm, acute-apiculate to acute to subacuminate (to retuse) at apex, rounded at base, abaxial surfaces ± densely pubescent with golden-brown multicellular eglandular trichomes 0.5–1 mm, adaxial surfaces pubescent with antrorse eglandular trichomes 0.3–1 mm, trichomes usually denser on major veins, margin ciliate. Inflorescence of 1 to 5 flowers in leaf axils, flowers alternate or opposite at nodes, pedunculate, peduncles to 30 mm, pubescent-like young stems; bracteoles sublanceolate to ovate to subcircular, (4–)6.2–15.6 × 3–12.2 mm, acute to subacuminate to apiculate at apex, abaxial surfaces densely pubescent with woolly, golden-brown, eglandular trichomes to 1.5 mm, adaxial surfaces mealy-glandular. Calyx consisting of a rigid, entire, undulating, annular or cupular ring surrounding

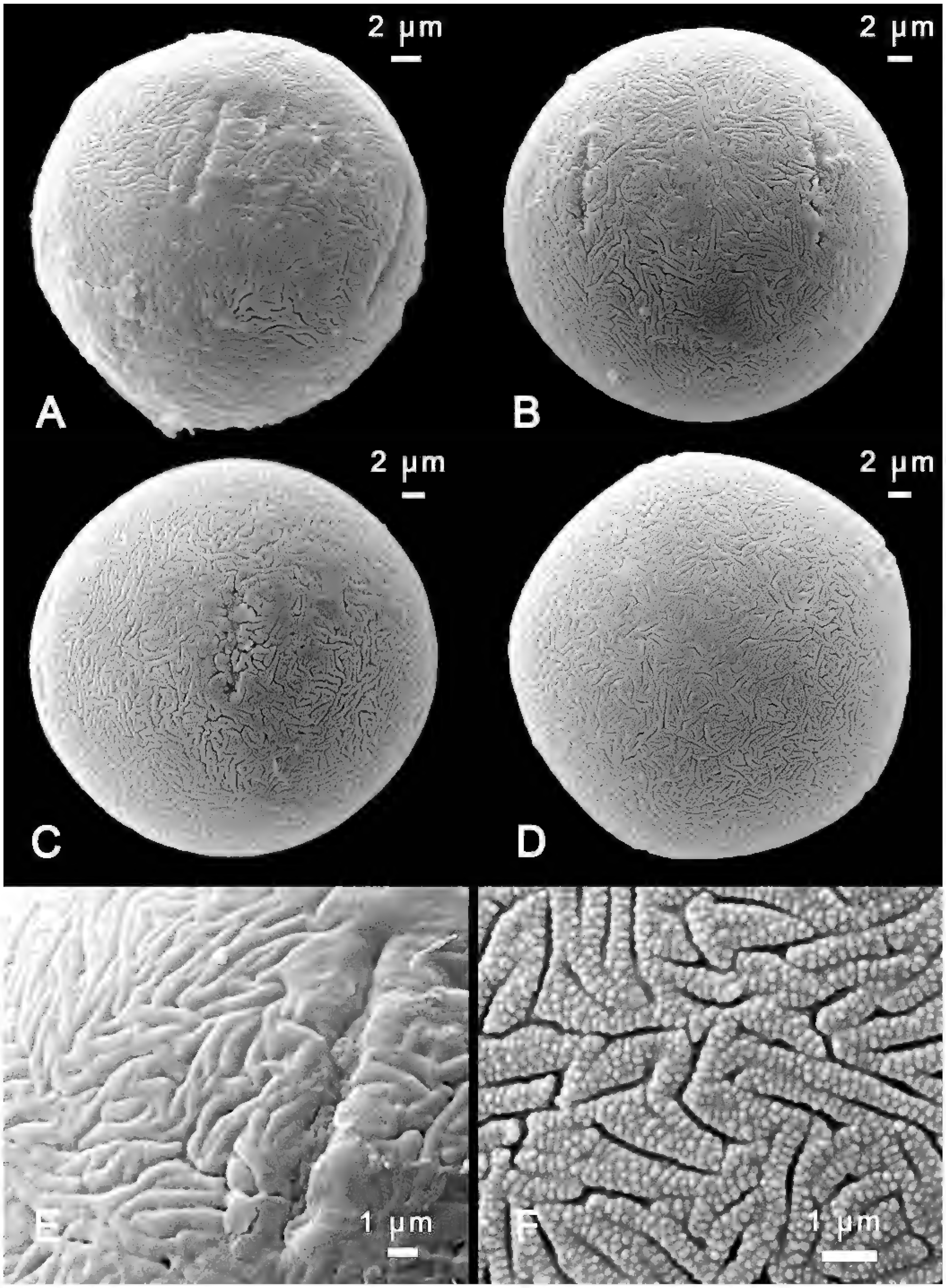


Figure 3. Pollen of *Mendoncia delphina* E. Magnaghi and *M. kely* E. Magnaghi. —A. *Mendoncia kely*, subequatorial/apertural view. —B. *Mendoncia delphina*, equatorial/interapertural view. —C. *Mendoncia delphina*, equatorial/apertural view. —D. *Mendoncia delphina*, polar view. —E. *Mendoncia kely*, close-up of rugulate surface (note smooth rugulae). —F. *Mendoncia delphina*, close-up of surface (note microverrucate rugulae). A, E from the paratype *O. Andrianantoanina et al. 11* (MO); B–D and F from the type *S. Malcomber et al. 1665* (MO).

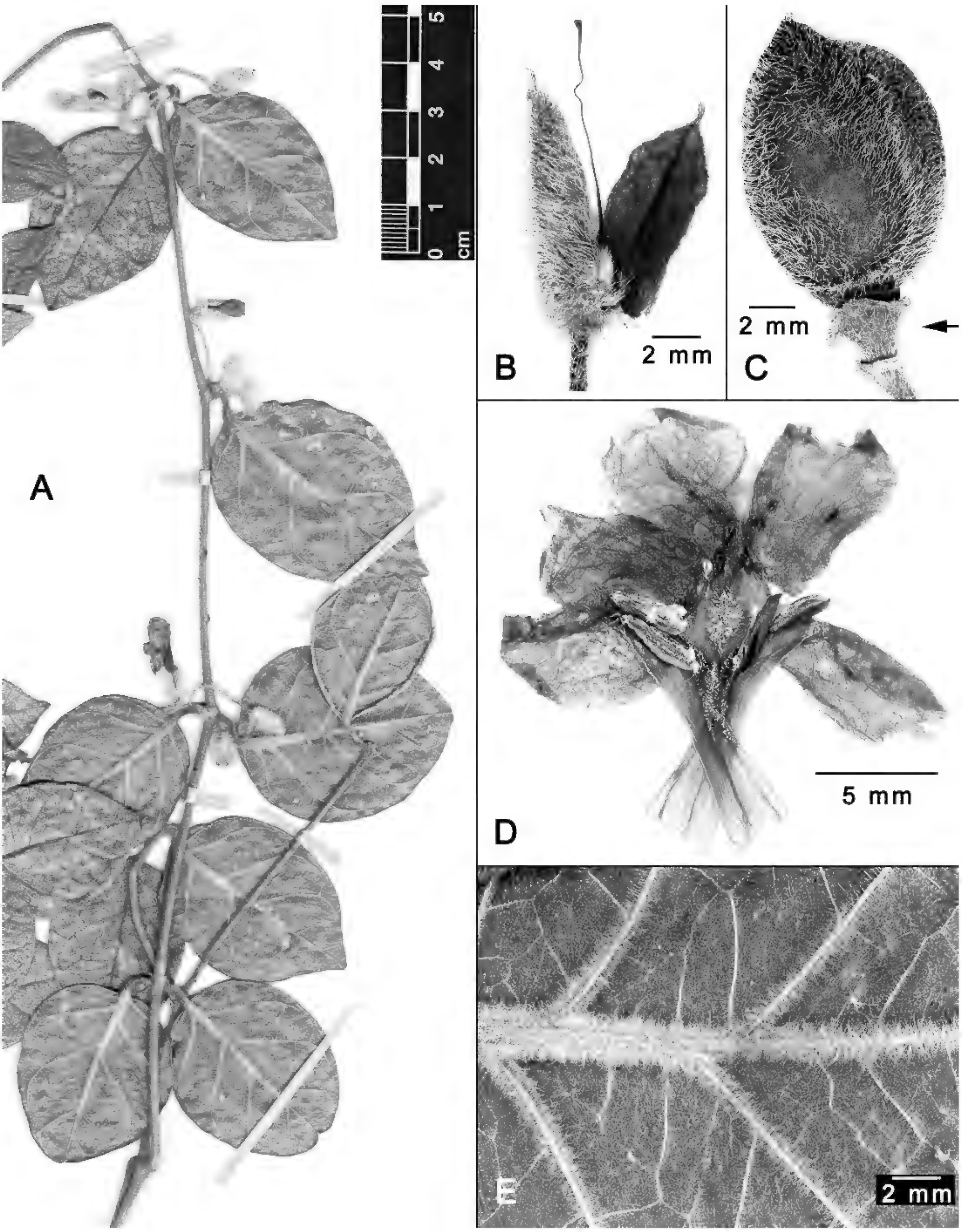


Figure 4. *Mendoncia kely* E. Magnaghi. —A. Habit with flowers. —B. Bracteoles after corolla has fallen, showing gynoecium. —C. Drupe, with calyx indicated by arrow. —D. Corolla dissected to reveal androecium. —E. Close-up of pubescent abaxial leaf surface with denser trichomes on major veins. A, E from the type *J.-H. Humbert 23067* (K, P, MO); B, D from *C. Rakotovao et al. 2740* (MO); C from *O. Andrianantoanina et al. 221* (MO).

nectar disc, 0.8–1.6 mm high, densely pubescent with light brown to golden eglandular trichomes to 1 mm; corolla pink proximally and white distally, white with purple spots, or purple with white spots, 13.2–19 mm, externally glabrous, tube 10–14 mm, throat with a central cluster of glandular trichomes at base of lower lip lobe, apically ampliate, limb 9.3–16.4 mm diam., upper lip 4.7–8 mm with rounded lobes

3.6–6.5 × 3–6 mm, lower lip 6.5–8 mm with rounded lobes 3.5–7.2 × 4.4–8 mm; stamens 4–5 mm, inserted near the middle of the corolla tube, ventral pair inserted 0.8–1 mm distal to the dorsal pair, filaments mealy glandular below thecae and onto corolla tube, thecae 3.3–3.5 mm, pubescent at base with a tuft of stout eglandular trichomes extending toward apex, connective projecting 0.2 mm beyond apex of the thecae; pollen 5-brevicolpate; style 9–9.8 mm, stigma subequally 2-lobed, lobes 0.2–0.4 mm. Drupe green (immature) to brown (mature), ovoid to spherical, 8.4–13.2 mm × 7.1–10.5 mm, surface pubescent with appressed light brown to golden trichomes to 0.3–0.5 mm.

Distribution and habitat. *Mendoncia kely* is endemic to Madagascar, where it occurs in both the northern and southeastern portions of the island (former provinces of Antsiranana and Toliara). Plants occur in lowland to montane, wet-evergreen forests at elevations between 250 and 1200 m.

IUCN Red List category and conservation data. *Mendoncia kely* is known from 15 collections representing at least nine sites from northern to southern Madagascar. The population of this species was treated as consisting of three disjunct subpopulations: a northern subpopulation (four sites; EOO ca. 80 km^2), which is about 180 km distant from the central subpopulation; a central subpopulation (four sites; EOO ca. 356 km^2); and a southern subpopulation (1 site; EOO estimated to be 1 km^2), which is about 1130 km from the central subpopulation. The total EOO is ca. 58,850 km^2, and the AOO is 36 km^2. Based on the AOO, *M. kely* would be classified as Endangered (EN) under IUCN criterion B2 if appropriate knowledge of subcriteria b or c were available. Several collection sites from the northern subpopulation occur in Montagne d'Ambre National Park, at least one site in the central subpopulation occurs adjacent to the Marojejy Nature Reserve, and the sole site in the southern subpopulation is in the Andohahela National Park. In view of its broad distribution (though apparently fragmented based on known collections) and occurrence in at least two protected lands, we propose a provisional assessment of Vulnerable (VU) for *M. kely*.

Phenology. Flowering collections of *Mendoncia kely* have been made in January and February; fruiting collections are known from July to November.

Etymology. The epithet is taken from a Malagasy expression for small (*kely ray* or *kely reny*) and refers to the diminutive size of many of the leaves and reproductive parts of *Mendoncia kely* compared to *M. cowanii*.

Discussion. Specimens of *Mendoncia kely* have sometimes been identified as *M. cowanii*, which flowers at the same time and shows similarities in leaf texture and pubescence. Characters noted in the key above distinguish it from that and other species. When flowers are present, the smaller size of the corolla readily distinguishes *M. kely* from *M. cowanii*. Flowers of *M. kely* resemble those of *M. flagellaris* in size, but their stigmas, unlike the capitate stigmas of *M. flagellaris*, are subequally 2-lobed like those of *M. cowanii*. Although the leaf shape in *M. kely* is variable as noted above, most of the leaves are relatively small (up to 75 mm long and 45 mm wide) and broadly elliptic (length/width ratio 1.4–1.7). Leaves of *M. cowanii* are also variable, but they tend to be larger (up to 138 mm long and 77 mm wide) and more narrowly elliptic (length/width ratio 1.7–2.8). The bracteoles of *M. kely* are smaller (4–15.6 vs. 16–28 mm) than those of *M. cowanii* and, unlike those of that species, do not appear to be filled with fluid.

Paratypes. MADAGASCAR. **Antsiranana:** Roussettes SF, 12°31′S, 49°08′E, *O. Andrianantoanina & R. Bezana 213* (BR, MO); Fivondronana Antsiranana II, Parc Nat. Montagne d'Ambre, 70 km SW d'Antsiranana et 9 km W du village de Marovato Scama (Anivorano), camp. Andasibe, 12°37′30″S, 49°11′43″E, *O. Andrianantoanina & R. Bezana 777* (BR, MO); S d'Antsiranana, près de Joffre-Ville, à la station Roussette, 12°27′S, 49°13′E, *O. Andrianantoanina & B. Rocsceohclher 364* (BR, MO); près d'Antsalaka, Montagne d'Ambre Parc Nat., 12°27′S, 49°13′E, *O. Andrianantoanina, B. Rocsceohclher & G. Rajaonarivelo 221* (BR, MO); Sava, Andapa, Anjialavabe, Ankiakabe, Tsaralanto, 14°13′59″S, 49°23′17″E, *P. Antilahimena, Randriamandimby, Tianina & Patrio 4587* (CAS); Montagne d'Ambre, *T. Daniel & M. Butterwick 6742* (CAS), *T. Daniel, H. Ranarivelo & A. Razafimanantsoa 10591* (CAS); WNW of Andapa, NW of Ambodisatrana, 14°32′S, 49°26′E, *G. McPherson 17159* (MO); Sava, Andapa, Ambodivohitra, Tsaralanto, 12 km SW de Anjialavabe et N d'Anjialavahely, 14°14′12″S, 49°23′05″E, *C. Rakotovao, J. Ihasotra & J. Rabevazaha 2740* (MO); Montagne d'Ambre, partie central, 12°35′S, 49°10′E, *S. Ramandimbimanana et al. SDR047* (G); Antalaha, Andapa, Bealampona, Mandritsarahely, SW d'Andapa, Rés. Spéc. Anjanaharibe-Sud, vers Ranomafana, 5.5 km SW de Befingotra, camp. 1, 14°45′03″S, 49°30′03″E, *D. Ravelonarivo, B. Lewis & R. Rabesonina 451* (MO); Montagne d'Ambre, partie central, 12°35′S, 49°10′E, *S. Trigui, M. Razanajatovo & S. Ramandimbimanana SMT220* (G), *SMT306* (G). **Toliara:** Andohahela RNI, Parcelle 1, Itrotroky River, NW of Eminiminy, Ft. Dauphin, 24°38′S, 46°46′E, *O. Andrianantoanina, H. van der Werff, C. Hemingway, M. van Bergen, S. Rapanarivo, S. Malcomber, P. Rakotomalaza & B. Randriamampionona 11* (BR, G, MO).

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Hydrocotyle (Araliaceae) en Bolivia II: Especies en la Zona de Siberia, Parque Nacional Amboró, Santa Cruz, Bolivia

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Resumen. Se presenta una revisión taxonómica de *Hydrocotyle* L. (Araliaceae), para las especies nativas del bosque siempre nublado de Siberia, Parque Nacional Amboró (Bolivia). Seis especies son conocidas en la zona, y cuatro de ellas son descritas como nuevas: *H. adrianae* M. Mend., *H. felipae* M. Mend., *H. juanae* M. Mend. e *H. lopeziae* M. Mend., las cuatro son presumiblemente endémicas a esta región. Las especies nuevas son descritas e ilustradas. Se incluye una clave para facilitar su identificación, se discuten diferencias taxonómicas con especies afines y se proporcionan notas sobre ecología y distribución natural para cada especie.

Abstract. A taxonomical review of the *Hydrocotyle* L. (Araliaceae), species native to the Siberia cloud forest, Parque Nacional Amboró (Bolivia), is presented. Six species are known from this zone, four of which are described as new: *H. adrianae* M. Mend., *H. felipae* M. Mend., *H. juanae* M. Mend., and *H. lopeziae* M. Mend, all of them presumably endemic to the region. The new species are illustrated, a key to facilitate identification is provided, taxonomical differences between related species are discussed, and notes on the ecology and natural distribution are given for each species.

Key words: Araliaceae, Bolivia, cloud forest, *Hydrocotyle*, IUCN Red List.

El estudio de especímenes recolectados en la zona de Siberia en los últimos 20 años, con el impulso del proyecto Flora del Parque Nacional Amboró, y más recientemente la ejecución del proyecto Endemismos de las plantas en los valles centrales andinos de Bolivia (2002–2006) permitieron una mejor, aunque todavía no completa, exploración y estudio de la flora del lugar. El bosque nublado de Siberia es una de las regiones más ricas y diversas en especies vegetales de Bolivia; la recolección de especímenes en diferentes familias botánicas y su posterior estudio, ha dado lugar a un incremento del número de especies conocidas para el área, identificando y describiendo nuevas especies: *Capsicum* L. (una sp.) y *Solanum* L. (dos spp.) en Solanaceae (Nee et al., 2006), *Salvia* L. (dos spp.) en Lamiaceae (Wood, 2007) y *Eryngium* L. (dos spp.) en Apiaceae (Mendoza & Watson, 2008), entre otros. Estos descubrimientos sumados al elevado número de especies endémicas y los altos valores de riqueza y diversidad que se han registrado en el área, la sitúan como un ecosistema altamente interesante para posteriores estudios botánicos y biológicos en general.

La taxonomía del género *Hydrocotyle* L. (Araliaceae) en general no es clara y en Bolivia su estudio es reciente. El proyecto Catálogo de Plantas Vasculares de Bolivia (en ejecución) registra 16 especies. Mendoza (2013) reconoce 19 especies debidamente identificadas para el país, pero también registra otras "especies o entidades" morfológicamente separables, que fueron identificadas sólo a nivel genérico. Para el área de estudio, *Hydrocotyle* es representado por un total de seis especies nativas, cuatro de las cuales son descritas y propuestas como nuevas especies, y al ser conocidas sólo de esta zona, son consideradas endémicas a Bolivia y más propiamente a las altas montañas del bosque siempre nublado de Siberia.

Materiales y Métodos

Fueron revisados materiales depositados en los herbarios: BOLV, K, LPB, MO, NY, USZ. Observaciones in situ para cada especie fueron realizadas entre los años 2001 al 2011. Las ilustraciones de las nuevas especies fueron realizadas por Carlos Maldonado (LPB).

Hydrocotyle L., Sp. Pl. 1: 234–235. 1753. TYPE: *Hydrocotyle vulgaris* L., lectotipo designado por Hitchcock (1929: 138).

Hierbas perennes, rastreras, ascendentes hasta péndulas, glabras y/o pubescentes, raíces adventicias en los nudos; tallos lineales, filiformes a robustos, membranosos o fibrosos, glabros en general. Hojas simples, peltadas o no peltadas; estípulas 2, envolventes, laminares, membranosas y glabras;

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pecíolos libres, teretes, lisos o variadamente pubescentes más hacia los nudos y/o la inserción laminar; láminas orbiculares, orbicular-reniformes u orbicular-deltoides, lobadas; lóbulos crenados, lobulados hasta angulosos, a veces el lóbulo apical acuminado. Inflorescencias en umbelas o glomérulos simples; pedúnculos teretes, iguales, mayores o menores que los pedicelos; pedicelos filiformes. Flores blanco-verdosas, amarillentas hasta púrpuras; sépalos diminutos o ausentes; pétalos 5, libres y abiertos, ovados a lanceolados, planos o suavemente reflexos. Frutos ovados, globosos o transversalmente-ovados; estilopodio cónico o achatado; costillas pronunciadas, filiformes o ausentes.

Clave para las Seis Especies de *Hydrocotyle* de la Zona de Siberia, Santa Cruz, Bolivia

1a. Hojas peltadas.
  2a. Hojas orbiculares a orbicular-deltoides, lóbulos todos iguales, láminas hirsutas, setosas o villosas.
    3a. Hojas grandes, (3)4–8 cm de diámetro, inflorescencias multifloras (30 a 40 flores); setosas en ambas superficies; lóbulos angulosos ..... *H. juanae*
    3b. Hojas pequeñas, 1–2(2.5) cm de diámetro; inflorescencias paucifloras (2 a 10 flores); hirsutas o villosas en la superficie adaxial; lóbulos crenados o lobulados, no angulosos.
      4a. Hojas breve hendido-lobadas; pedicelos 1.5–4 mm de largo; pedúnculos emergentes ... *H. adrianae*
      4b. Hojas lobadas, no hendidas; pedicelos $\leq$ 0.5 mm de largo; pedúnculos no emergentes ... *H. pusilla*
  2b. Hojas ovado-acuminadas, lóbulo apical fuertemente acuminado, láminas glabras o raramente hirsútulas hacia el margen ..... *H. eccentrica*
1b. Hojas no peltadas (emarginadas).
  5a. Hojas orbicular-acuminadas, lóbulos lobulados a lobulado-dentados, los apicales angulosos y más desarrollados; láminas esparcido-hirsútulas hacia el borde, la base glabra; pedicelos 1.5–2.5 mm ... *H. felipae*
  5b. Hojas reniformes a orbicular-reniformes, lóbulos lobulado-crenados, los apicales nunca angulosos ni desarrollados; láminas estrigoso-hirsutas de la base al borde; pedicelos 3–6 mm ..... *H. lopeziae*

1. Hydrocotyle adrianae M. Mend., sp. nov. TIPO: Bolivia. Santa Cruz: Prov. J. M. M. Caballero, Khara Huasi, ca. 28 km de Comarapa hacia Siberia, ca. cruce Khara Huasi, 17°49′20.9″S, 64°40′52.2″W, 2548 m, 18 dic. 2011, *M. Mendoza, D. Santamaria & L. Lagomarcino 3939* (holotipo, USZ; isotipos, K, LPB, MO, NY). Figuras 1, 4A, B.

Species nova *Hydrocotyli pusillae* A. Rich. affinis, sed ab ea foliis adaxialiter hirsutis (non sparsim villosis) subtiliter breviterque duplolobatis (non leniter lobatis lobis tantum crenatis), petiolis quam caulibus latioribus (non eos latitudine aequantibus), pedunculis quam pedicellis longioribus (non aequalibus vel brevioribus), pedicellis 1.5–4 (non < 0.5) mm longis et umbellis 6- a 10-(non 2- a 6-)floris differt.

Hierba rastrera a péndula, 20–40(–60) cm de largo, frágil o delicada; tallos filiformes con nudos escasamente engrosados, glabros, a veces con pelos setosos solitarios. Hojas peltadas; estípulas ovadas a ovado-lanceoladas o ausentes en tallos maduros, margen usualmente dentado; pecíolos 1–5(–8) cm, normalmente más gruesos en la base, densamente retrorso-hirsútulo en la inserción laminar y gradualmente glabrescente hacia la base; laminas orbiculares, 1–2(–2.5) cm diám., breve hendido-lobadas, 6 a 7 lobadas; lóbulos 3-lobulados, a veces con dos pseudolóbulos a la orilla; superficie adaxial hirsuta, sobre todo en las venas, superficie abaxial normalmente glabra. Umbelas paucifloras, 6 a 10 floras, 4–6 mm diám.; pedúnculos erectos, emergentes mayores que los pecíolos, glabros; brácteas ovado-lanceoladas, reflexas, usualmente dentadas, ápice agudo hasta atenuado; pedicelos filiformes, glabros, desiguales en tamaño, 1.5–4 mm, rectos. Flores con pétalos ovado-lanceolados, reflexos, blanco-amarillentos o con tinte lila, nervio central marcado, ápice agudo a acuminado; estambres con filamentos cortos, hasta 0.5 mm de largo, anteras elípticas, amarillas. Frutos suborbiculares, achatados en los polos, base subcordada, 0.9–1.1 × 1.5–1.8 mm, glabros; costillas ausentes; estilopodios depresos; estilos reducidos y divaricados, < 0.2 mm.

Distribución y ecología. *Hydrocotyle adrianae* es conocida sólo del área de la localidad tipo, con poblaciones muy localmente dispersas pero restringidas a la zona del cruce de Khara Huasi hacia Comarapa. Se desarrolla en áreas bien conservadas de bosque primario con leve perturbación ocasionada por labores de limpieza en la carretera o paso eventual de vacunos, creciendo como rastrera entre pastos o epifita sobre roca cubierta de musgos y materia orgánica, siempre en lugares con mucha sombra y humedad, entre 2520 y 2548 m de altitud.

Categoría de la Lista Roja de UICN. Basados en la información disponible, se puede concluir que *Hydrocotyle adrianae*, es endémica a la zona del bosque siempre nublado de Siberia en el departamento de Santa Cruz, Bolivia, pero, esta nueva especie y sus poblaciones naturales aún no han sido suficientemente estudiadas, como para fundamentar

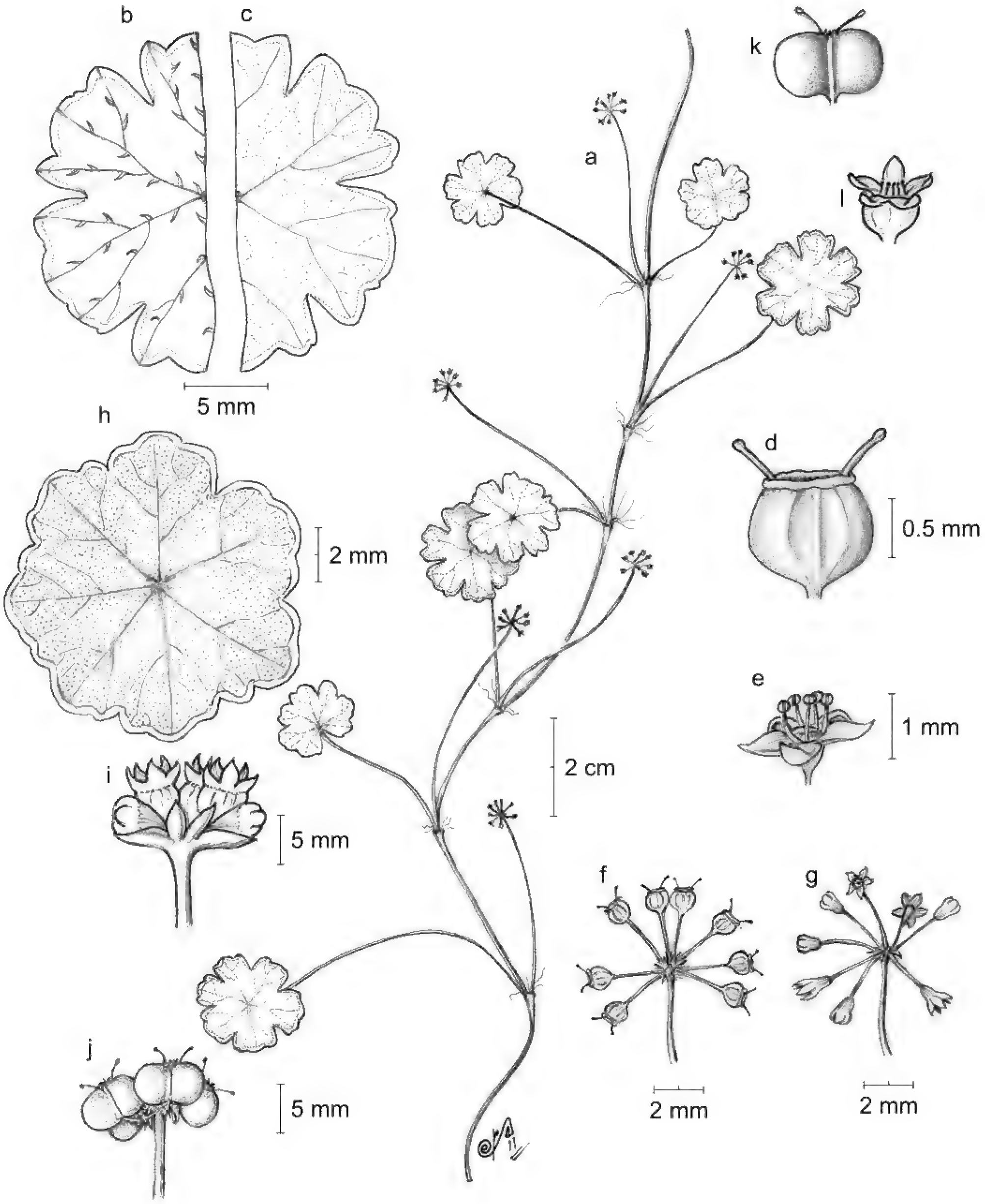


Figura 1. A–G. *Hydrocotyle adrianae* M. Mend. —A. Hábito, rama fértil. —B. Detalle de pubescencia y venación foliar, superficie adaxial. —C. Detalle de venación foliar glabra, superficie abaxial. —D. Fruto (inmaduro). —E. Flor. —F. Infrutescencia. —G. Inflorescencia. H–L. *Hydrocotyle pusilla* A. Rich. —H. Forma de la hoja, vista frontal. —I. Inflorescencia. —J. Infrutescencia. —K. Fruto. —L. Flor. A–G del tipo *M. Mendoza, D. Santamaria & L. Lagomarcino 3939* (USZ); H–L, de *M. Mendoza et al. 156* (USZ).

una categoría de listas rojas. De acuerdo a criterios de UICN (2011) se la propone a este taxón como Datos Insuficientes (DD).

Etimología. El nombre de esta especie es dedicada a Ivonne Adriana Eduardo Palma (1981–), quien me permitió confirmar que no hay límites o barreras cuando se tiene la voluntad de cumplir con una meta, que cuando las personas se unen en ideas y propósitos, a pesar de todo, se podrá alcanzar la meta planificada.

Discusión. Dentro del área de estudio, Bolivia y a nivel global, la especie más cercana es *Hydrocotyle*

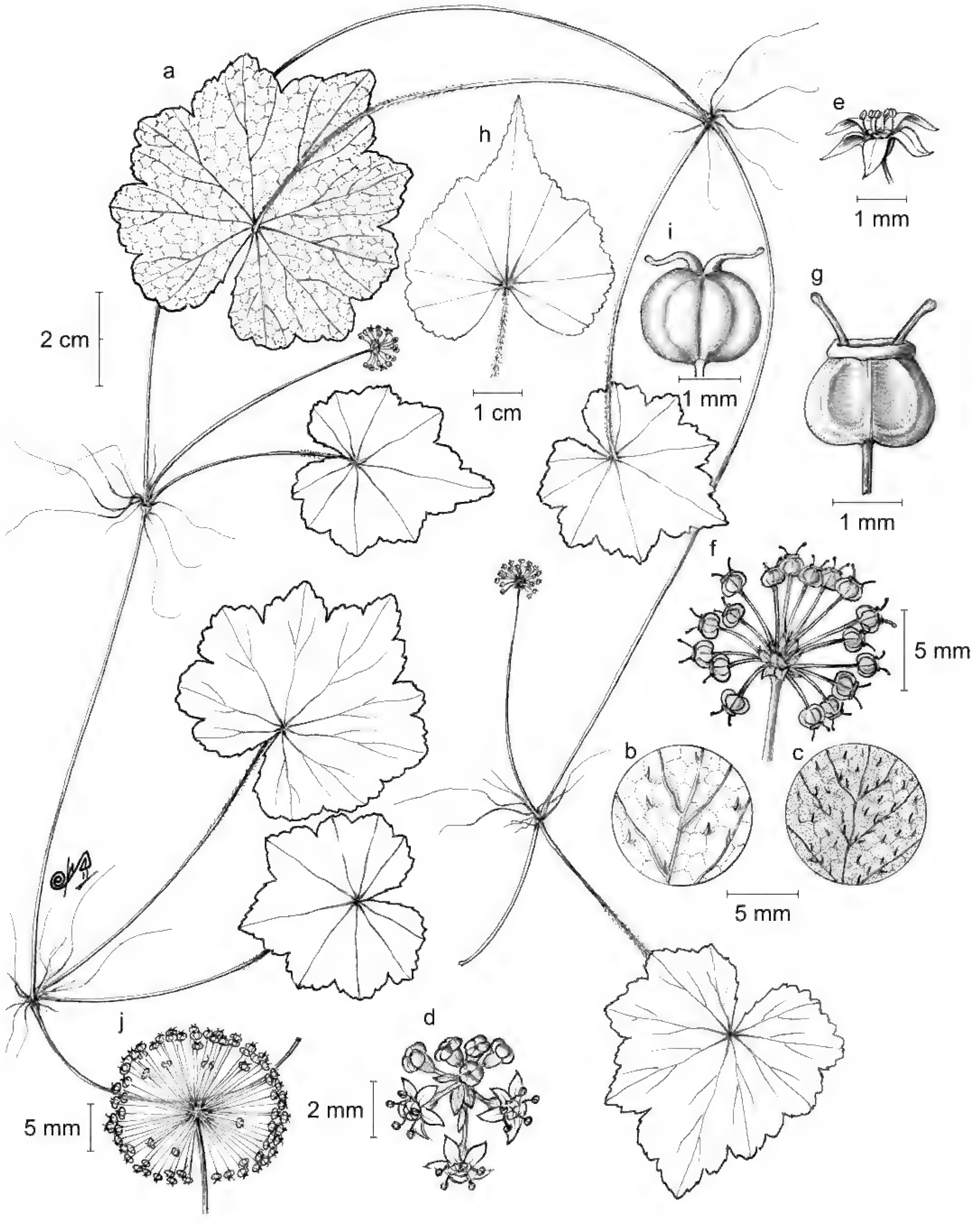


Figura 2. A–G. *Hydrocotyle felipae* M. Mend. —A. Hábito, rama fértil. —B. Detalle, pubescencia en la superficie foliar, adaxial. —C. Detalle, pubescencia en superficie foliar, abaxial. —D. Inflorescencia. —E. Flor abierta. —F. Infrutescencia. —G. Fruto glabro. H–J. *Hydrocotyle acutifolia* Ruiz & Pav. —H. Hoja. —I. Fruto. —J. Inflorescencia. A–G del tipo *M. Mendoza & V. Antezana 3740* (USZ); H–J, de *R. Vásquez 27743* (MO)

pusilla. Se diferencia por sus hojas, breve hendido-lobadas, lóbulos lobulados, umbelas con seis a 10 flores, pedicelos 1.5–4 mm de largo y pedúnculos emergentes; mientras que *H. pusilla* presenta hojas suavemente lobadas, lóbulos crenados y no breve hendido-lobados, umbelas con dos a seis flores; pedicelos $\leq$ 0.5 mm y menores a los pecíolos, no emergentes.

Paratipos. BOLIVIA. **Santa Cruz:** Prov. J. M. M. Caballero, Siberia, carretera Khara Huasi Comarapa, ca.

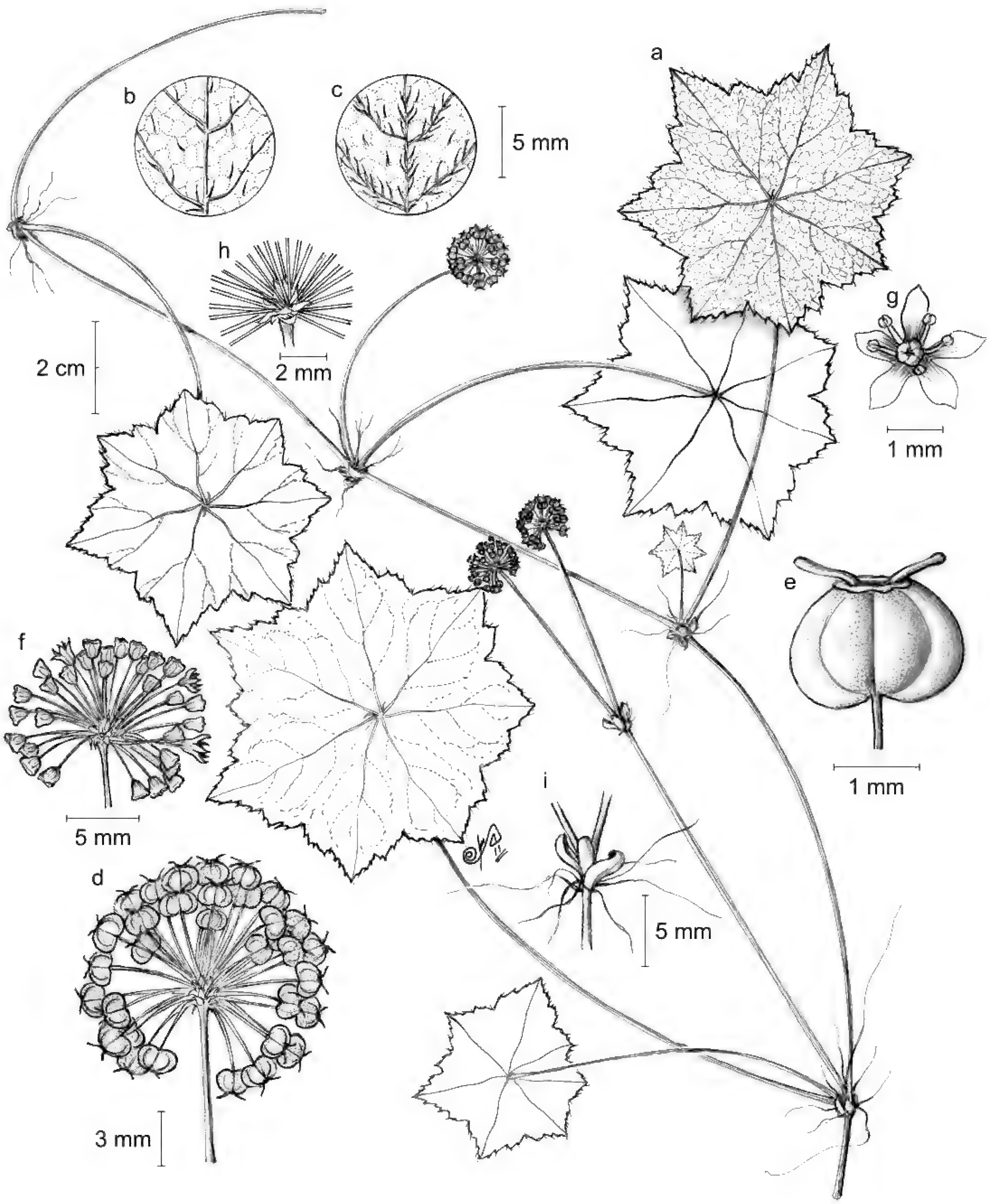


Figura 3. *Hydrocotyle juanae* M. Mend. —A. Hábito, rama fértil. —B. Detalle, pubescencia en superficie foliar adaxial. —C. Detalle, pubescencia en superficie foliar abaxial. —D. Infrutescencia. —E. Fruto, glabro. —F. Inflorescencia. —G. Flor, abierta. —H. Detalle, brácteas en las bases del pedicelo. —I. Detalle de estípulas. A–H del tipo *M. Mendoza & V. Antezana 3739*.

8–10 km de Khara Huasi, 17°49′47″S, 64°41′32″W, 2520 m, 9 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 627* (K, LPB, MO, NY, USZ); 17°49′28″S, 64°41′20″W, 2520 m, 26 mar. 2004, *M. Mendoza & S. Acebo 923* (K, LPB, NY, USZ).

2. Hydrocotyle eccentrica Britton, Bull. Torrey Bot. Club 18: 36. 1891. TIPO: Bolivia. Yungas, 6000 ft., 1885, *H. H. Rusby 1761* (holotipo, NY; isotipos, NY, US).

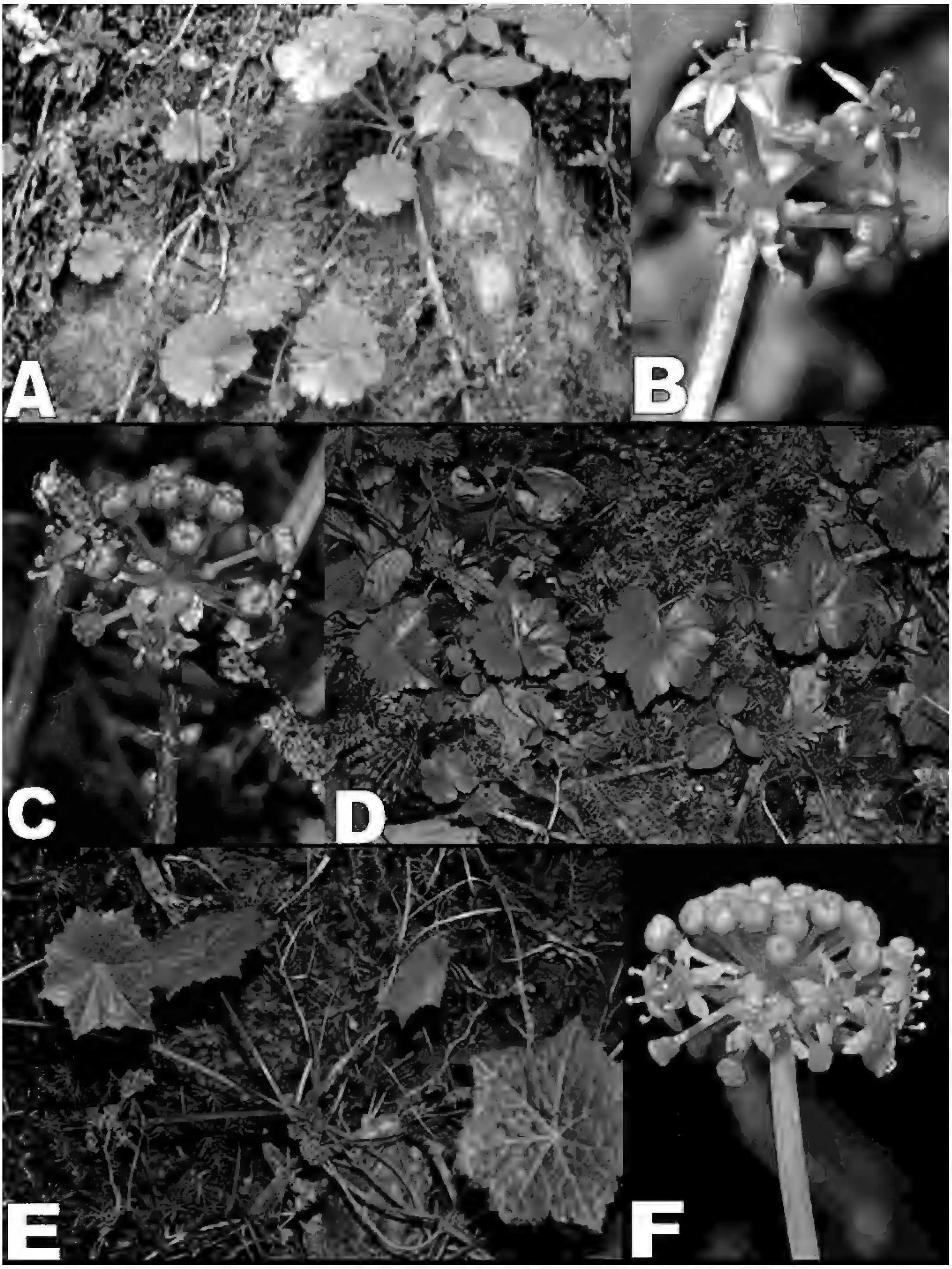


Figura 4. Hábito y detalles de inflorescencia en hábitat natural. —A y B. *Hydrocotyle adrianae* M. Mend. —A. Hábito. —B. Detalle, disposición de flores en inflorescencia. —C y D. *Hydrocotyle felipae* M. Mend. —C. Detalle, disposición de flores en inflorescencia. —D. Hábito. —E y F. *Hydrocotyle juanae* M. Mend. —E. Hábito. —F. Detalle, disposición de flores en inflorescencia. Fotos de las muestras tipo; A y B de *M. Mendoza, D. Santamaria & L. Lagomarcino 3939*; C y D de *M. Mendoza & V. Antezana 3740*; E y F de *M. Mendoza & V. Antezana 3739*.

Hierba rastrera, ascendente hasta péndula, 30–60(–100) cm, robusta a semi-robusta; tallos híspidos más hacia los nudos o glabros, 1–1.5 mm diám. Hojas peltadas; estípulas deprimido-ovadas a ampliamente ovadas, margen dentado hasta a veces entero; pecíolos (1–)10–15(–20) cm, esencialmente lisos pero con finos pelos hirsútulos en la base; láminas ovadas, ovado-acuminadas, acuminadas, 1.5–4.5(–6) cm diám., 9 a 11 lobadas, el lóbulo apical fuertemente acuminado; lóbulos dentados o dentado-crenados, los apicales frecuentemente angulosos y más desarrollados; glabras en ambas superficies o escasos pelos hirsútulos hacia el margen de la superficie adaxial. Umbelas multifloras, 15 a 30 floras, 1–1.5 cm diám.; pedúnculos iguales o mayores que los pecíolos, glabros o esparcidamente hirsútulos en la base; brácteas lanceoladas a linear-lanceoladas, enteras o dentadas en la base, ápice agudo-acuminado; pedicelos filiformes, desiguales en tamaño, glabros, 3–7 mm. Flores con pétalos ovado-lanceolados, reflexos, verde-amarillentos a rojizos, el nervio central marcado, ápice agudo; estambres con filamentos reducidos, 0.2–0.3 mm, base robusta, anteras elípticas, amarillas. Frutos ovados a sub-orbiculares, base cordada, 1–1.3 × 2–2.5 mm, glabros; costillas filiformes a obsoletas; estilopodios depresos; estilos persistentes y divaricados, hasta 0.6 mm.

Distribución y ecología. *Hydrocotyle eccentrica* es una especie de distribución limitada a Bolivia y Perú. Es frecuente a abundante en la zona de estudio, principalmente en bosques con moderada perturbación, donde es normal encontrarla en senderos, borde de caminos, orillas de potreros, creciendo entre pastos y/o hierbas o hasta colgantes a orillas de laderas, entre 2500 y 3000 m de altitud.

Discusión. En la zona de estudio, no podrá confundirse con ninguna otra especie, sus láminas peltadas, ovado-acuminadas, con el lóbulo apical fuertemente acuminado, la distinguen con facilidad. En Bolivia podría confundirse con *Hydrocotyle acuminata* Urb. e *H. boliviana* (Kuntze) Mathias, las tres presentan hojas peltadas y en general forma similar, pero se diferencia por ser una planta semi-robusta a robusta, con hojas glabras en ambas superficies o esparcidamente hirsútulas hacia el margen de la superficie adaxial. *Hydrocotyle acuminata* presenta una apariencia delicada, lóbulos lobulados a lobulado-dentados, los apicales pueden ser más desarrollados, pero no angulosos, costillas prominentes y angulosas en frutos. También *H. boliviana* mantiene apariencia delicada, láminas hirsutas en ambas superficies, lóbulos lobulado-dentados a inciso-serrados y lobulados y/o angulosos, los apicales pueden o no ser más desarrollados, frutos pubescentes con costillas prominentes y angulosas.

Adicional material examinado. BOLIVIA. **Santa Cruz:** Prov. Florida, ca. 5–6 km de Samaipata, prox. del cerro la Mina, 18°07′06″S, 63°52′20″W, 2219 m, 28 feb. 2004, *M. Mendoza, J. R. I. Wood & H. Huaylla 882* (USZ). Prov. J. M. M. Caballero, Comarapa, camino hacia Cerro Bravo, ca. 2 km antes de llegar a Laguna Verde, 18°33′43″S, 64°04′58″W, 2003 m, 8 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 617* (K, LPB, MO NY, USZ). PERU. **Huancavelica:** Prov. Tayacaja, Monte Pungo, 5 km E of Surcubamba, 3000 m, 13 jan. 1939, *H. E. Stork & O. B. Horton 10390* (MO).

3. Hydrocotyle felipae M. Mend., sp. nov. TIPO: Bolivia. Santa Cruz: Prov. J. M. M. Caballero, Siberia, carr. Khara Huasi Comarapa, pasando ca. 8–10 km de Khara Huasi, 17°49′16.4″S, 64°41′04.8″W, 2544 m, 11 jul. 2011, *M. Mendoza & V. Antezana 3740* (holotipo, USZ; isotipos, K, LPB, MO, NY). Figuras 2, 4C, D.

Species nova *Hydrocotyli vestitae* Mathias & Killip et *H. acutifoliae* Ruiz & Pav. affinis, sed ab eis umbellis medianis 10- a 20-(non 50- a 70-) floris, pedicellis 1.5–2.5 (non >5) mm longis, foliis lobo terminali breviter acuminato (nec valde acuminato nec attenuato), stylopodio depresso (non conico) et foliis adaxialiter fere glabris (non dense pubescentibus) differt.

Hierba rastrera a ascendente, 30–50(–80) cm; tallos semi-robustos con nudos suavemente engrosados, fibrosos, glabros, 0.8–1.2 mm diám. Hojas no peltadas; estípulas ovadas a angostamente ovadas, margen usualmente entero, rara vez finamente dentado; pecíolos (3–)10–15(–18) cm, abundantemente retrorso-hirsutos en la inserción laminar y gradualmente glabrescentes hasta glabros hacia la base; laminas orbiculares, acuminadas, 2–5(–7) cm diám., 7 a 9 lobadas; el lobo apical brevemente acuminado; lobos subiguales, 3-lobulados a lobulado-dentados, dientes terminando en un mucrón blanco (más notorio al envés), usualmente angulosos, los apicales más desarrollados; esencialmente glabras, esparcidamente hirsútulas hacia el margen en la superficie adaxial, suavemente hirsútulas en la superficie abaxial. Umbelas medianas, 10 a 20 floras, 5–8 mm diám.; pedúnculos mayores que los pecíolos, lisos; brácteas ovadas, suavemente reflexas, enteras o rara vez con dientes solitarios en la base, vena central muy notoria, ápice agudo; pedicelos filiformes, subiguales en tamaño, 1.5–2.5 mm, glabros. Flores con pétalos linear-lanceolados, reflexos, verdosos y de ápice rojizo, nervio central marcado, ápice agudo; estambres filamentos 0.3–0.4 mm, anteras elípticas, amarillas. Frutos ovados a

suborbiculares, base subcordada, 0.8–1 × 1.2–1.5 mm, glabros; costillas filiformes a obsoletas; estilopodios depresos; estilos persistentes y divaricados, hasta 0.5 mm.

Distribución y ecología. *Hydrocotyle felipae* es una especie considerada endémica a Bolivia, comparte distribución y hábitat general con *H. adrianae* (aquí descrita) pero es conocida sólo de una reducida área en la zona de la localidad tipo, donde se presenta una buena población pero muy localizada. Prefiere lugares un poco alterados, creciendo entre pastos y otras hierbas, en lugares con mucha sombra y humedad, cerca de la carretera, entre 2520 y 2700 m de altitud.

Categoría de la Lista Roja de UICN. La información disponible sugiere a esta especie como endémica a la zona de Siberia en el sector Khara Huasi, pero la ausencia de colectas y estudios que determinen su estado de conservación y distribución natural, no permite fundamentar una categoría de listas rojas, por tanto según criterios de UICN (2011) se la propone como Datos Insuficientes (DD), debido a la carencia de información más precisa sobre este taxón.

Etimología. El nombre de esta especie es dedicado a mi madre Felipa Flores de Mendoza (1953–) quien me brindo amor, cariño y enseñó con su vivo ejemplo a salir airoso de todas las pruebas, así seguir adelante aun la fatiga sea grande, dice: la perseverancia permitirá tus logros.

Discusión. En el área de estudio y en Bolivia no existe una especie con la cual pueda ser confundida, sus hojas no peltadas y orbicular-acuminadas la distinguen fácilmente; a nivel global comparte estos caracteres con *Hydrocotyle vestita* e *H. acutifolia* ambas nativas de Perú, la última extendiéndose hasta Ecuador. Se diferencia por el tamaño y número de flores en su inflorescencia (umbelas medianas, 5–8 mm diám., con 10 a 20 flores), lóbulo apical brevemente acuminado, además sus hojas son esparcidamente hirsútulas hacia el margen; mientras que *H. vestita* e *H. acutifolia* presentan umbelas más grandes, > 1 cm diám., con 50 a 70 flores, hojas con lóbulo apical fuertemente acuminado hasta atenuado, además toda la planta de *H. vestita* está cubierta de pelos hirsutos y largos, incluyendo las hojas en ambas superficies; por su parte *H. acutifolia* presenta tallos y pedicelos esparcidamente puberulentos a glabros, y hojas finamente pubescente en ambas superficies.

Paratipos. BOLIVIA. **Santa Cruz:** Prov. J. M. M. Caballero, N de Comarapa, 17°52′07″S, 57°30′05″W, 2700 m, 27 jul. 1998, *R. Darius 208* (USZ); Siberia, carretera Khara Huasi Comarapa, ca. 8–10 km de Khara Huasi, 17°49′47″S, 64°41′32″W, 2520 m, 9 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 625* (LPB, MO, NY, USZ), 17°49′28″S, 64°41′20″W, 2520 m, 26 mar. 2004, *M. Mendoza & S. Acebo 924* (K, LPB, MO, NY, USZ).

4. Hydrocotyle juanae M. Mend., sp. nov. TIPO: Bolivia. Santa Cruz: Prov. J. M. M. Caballero, Khara Huasi, ca. 29 km de Comarapa hacia Siberia, pasando cruce Khara Huasi, 17°49′20.9″S, 64°40′52.2″W, 2548 m, 11 jul. 2011, *M. Mendoza & V. Antezana 3739* (holotipo, USZ; isotipos, K, LPB, MO, NY). Figuras 3, 4E, F.

Species nova *Hydrocotyli hexagonae* Mathias et *H. humboldtii* A. Rich. affinis, sed ab eis caulibus petiolis pedicellisque glabris (nec puberulis scabrisve nec trichomatibus ad apicem instructis), foliis utrinque longisetosis (non abaxialiter glabris et adaxialiter pubescentibus vel glabris), marginibus foliorum serratis vel dentatis (nec duplo-crenatis nec serrato-crenatis) ad sinus ciliatis et filimentis basi robustis (nec filiformibus) viridibus vel purpureis (nec albis vel hyalinis) differt.

Hierba ascendente, trepadora a péndula, 0.5–2(–3) m, robusta; tallos robustos con nudos engrosados, fibrosos, glabros, 1–2 mm diám. Hojas peltadas; estípulas cóncavas, deprimido-ovadas a suborbiculares, a veces ausentes en tallos maduros, margen entero; pecíolos (6–)10–15(–20) cm, glabros; láminas orbiculares a deltoideas, (3–)4–8 cm diám., 7 a 8 lobadas; lóbulos subiguales, angulosos, 3-lobulados; márgenes serrado-dentados, dientes muy agudos o terminando en pelos rígidos, con 1 o 2 cilios largos en el seno de cada diente; pelos setosos largos en ambas superficies, más en las venas. Umbelas multifloras, 30 a 40 floras, 1.2–1.5 cm diám.; pedúnculos siempre menores que los pecíolos, glabros; brácteas lanceoladas a linear-lanceoladas, reflexas en la base, ascendentes a inflexas en el ápice, ápice agudo a acuminado; pedicelos filiformes, subiguales en tamaño, glabros, 4–6 mm. Flores con pétalos linear-lanceolados, abiertos a levemente reflexos, nervio central levemente marcado, ápice agudo, de color verde-amarillento; estambres con filamentos medianos, 0.5–0.6 mm, base robusta, de color verde o púrpura, anteras elípticas, amarillo-pálido. Frutos suborbicular-reniformes, base cordada, 1.2–1.5 × 2–2.3 mm, glabros; costillas filiformes a obsoletas; estilopodios depreso-cónicos; estilos persistentes y fuertemente divaricados, 0.7–0.9 mm.

Distribución y ecología. *Hydrocotyle juanae* es considerada endémica de Bolivia, y conocida solo del

bosque siempre nublado de Siberia en el Departamento de Santa Cruz, adyacente a la prov. Carrasco de Cochabamba. Se han observado algunas buenas poblaciones cercanas con plantas vigorosas en la zona. *Hydrocotyle juanae* se desarrolla en áreas bien conservadas de bosque primario, creciendo apoyada o hasta trepando sobre las ramas de arbustos, helechos arbóreos y entre musgos o gramíneas en laderas verticales, siempre lugares muy húmedos o con agua permanente, entre los 2000 a 2530 m de altitud.

Categoría de la Lista Roja de UICN. La información disponible de este nuevo taxón la sugiere como endémica a la zona de Siberia entre los departamentos de Cochabamba y Santa Cruz. Pero aún, no es posible estimar su distribución, tamaño y estado de conservación de sus poblaciones, por tanto, según los criterios de UICN (2011) se la propone como Datos Insuficientes (DD).

Etimología. El nombre de esta especie es dedicado a mi abuela Juana Mamani López (1927–1993) quien con su manera de ser, persona estricta, sus enseñanzas y su vivo ejemplo inculcó en mí los valores de responsabilidad, respeto al prójimo y amor a la vida.

Discusión. En la zona de estudio y en Bolivia no existe una especie que se pueda confundir con la presente, sus hojas peltadas, orbicular-deltoides, lóbulos subiguales y angulosos, la diferencian con facilidad de otras especies. A nivel global tiene semejanza con *Hydrocotyle hexagona* e *H. humboldtii* ambas nativas de Ecuador; esta última llega a Perú y se extiende hasta Colombia. Se distingue por sus hojas cubiertas de pelos setosos y largos en ambas superficies, margen serrado-dentado, dientes muy agudos o terminando en pelos rígidos y con uno o dos cilios largos en sus senos, filamentos con base robusta y de color verde o púrpura, además de tallos, pecíolos y pedicelos totalmente glabros. Mientras que *H. hexagona* presenta hojas puberulentas en la superficie adaxial, y usualmente glabras en la superficie abaxial, margen doblemente crenado, dientes agudos pero no terminando en pelos rígidos y libre de cilios en los senos, filamentos teretes y de color blanco, y finalmente tallos, pecíolos y pedicelos pubérulos. Por su parte, *H. humboldtii* tiene hojas esparcidamente hirsutas a escabrosas en la superficie adaxial y raramente en la superficie abaxial, margen doblemente crenado a crenado-serrado, dientes agudos pero sin terminar en pelos rígidos y senos libres de cilios, filamentos teretes y claros, además los tallos rara vez son escabrosos, pecíolos y pedicelos frecuentemente retrorso-hirsútulos hacia la inserción laminar.

Paratipos. BOLIVIA. **Cochabamba:** Prov. Carrasco, Siberia, carretera Mairana a Cochabamba, 17°49′12″S, 64°14′00″W, 2530 m, 4 mayo 2001, *M. Mendoza & M. Nee 25* (LPB, NY, USZ). **Santa Cruz:** Prov. J. M. M. Caballero, Siberia, carretera Khara Huasi Comarapa, ca. 8–10 km de Khara Huasi, entrando 20–30 m lado de un pequeño río, 17°49′32″S, 64°54′03″W, 2528 m, 26 mar. 2004, *M. Mendoza & S. Acebo 930* (K, LPB, NY, USZ); ca. 5–8 km de Khara Huasi, 2003 m, 9 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 621* (BOLV, MO, NY, USZ).

5. Hydrocotyle lopeziae M. Mend., sp. nov. TIPO: Bolivia. Santa Cruz: Prov. J. M. M. Caballero, ca. 27 km de Comarapa hacia Siberia, ca. Khara Huasi, 17°49′24.5″S, 64°40′25.5″W, 2559 m, 18 dic. 2011, *M. Mendoza, D. Santamaría & L. Lagomarcino 3938* (holotipo, USZ; isotipos, K, LPB, MO, NY). Figura 5.

Species nova *Hydrocotyli filipes* Mathias affinis, sed ab ea pedunculis ad apicem retrorse hirsutulis (non glabris), foliis utrinque estrigoso-hirsutis (nec glabris nec sparsim pubescentibus), lobis breviter divaricatis 3-lobulatis vel lobulato-crenatis (nec lobatis lobos crenatis vel duplo crenatis) differt.

Hierba rastrera a ascendente, 20–40(–70) cm; tallos delgados con nudos suavemente engrosados, sub-carnosos, completamente glabros, 0.2–1 mm diám. Hojas emarginadas; estípulas suborbiculares a ovadas, margen entero; pecíolos 3–7(–10) cm, normalmente más gruesos que los tallos, densamente retrorso-hirsútulos en la inserción laminar, gradualmente glabrescentes hasta glabros hacia la base; lámina orbicular-reniforme, 1.5–4(–5) cm diám., 7 a 9 lobada, lóbulos 3-lobados a lobulado-crenados, profundos y brevemente divaricados, adpresos, estrigoso-hirsutos desde la base al margen en ambas superficies, más densamente en el haz. Umbelas medianas, 10 a 15 floras, 5–7 mm diám.; pedúnculos mayores que los pecíolos, retrorso-hirsútulos en el ápice, gradualmente glabrescentes hasta glabros hacia la base; brácteas ovado-lanceoladas, rectas o suavemente reflexas, usualmente con 2 o 3 dientes desiguales hacia el ápice, vena central apenas notoria, ápice agudo; pedicelos filiformes, subiguales en tamaño, glabros, 1.5–2.5 mm. Flores con pétalos ovados a ovado-lanceolados, levemente reflexos, violáceos pero el ápice rojizo, nervio central marcado, ápice agudo; estambres con filamentos reducidos, 0.3–0.5 mm, anteras elípticas, amarillas. Frutos vistos inmaduros, globosos a suborbiculares, base marginada, 1–1.5 × 1.5–2 mm, glabros; costillas filiformes a obsoletas; estilopodios depresos; estilos persistentes y rectos, hasta 0.4 mm.

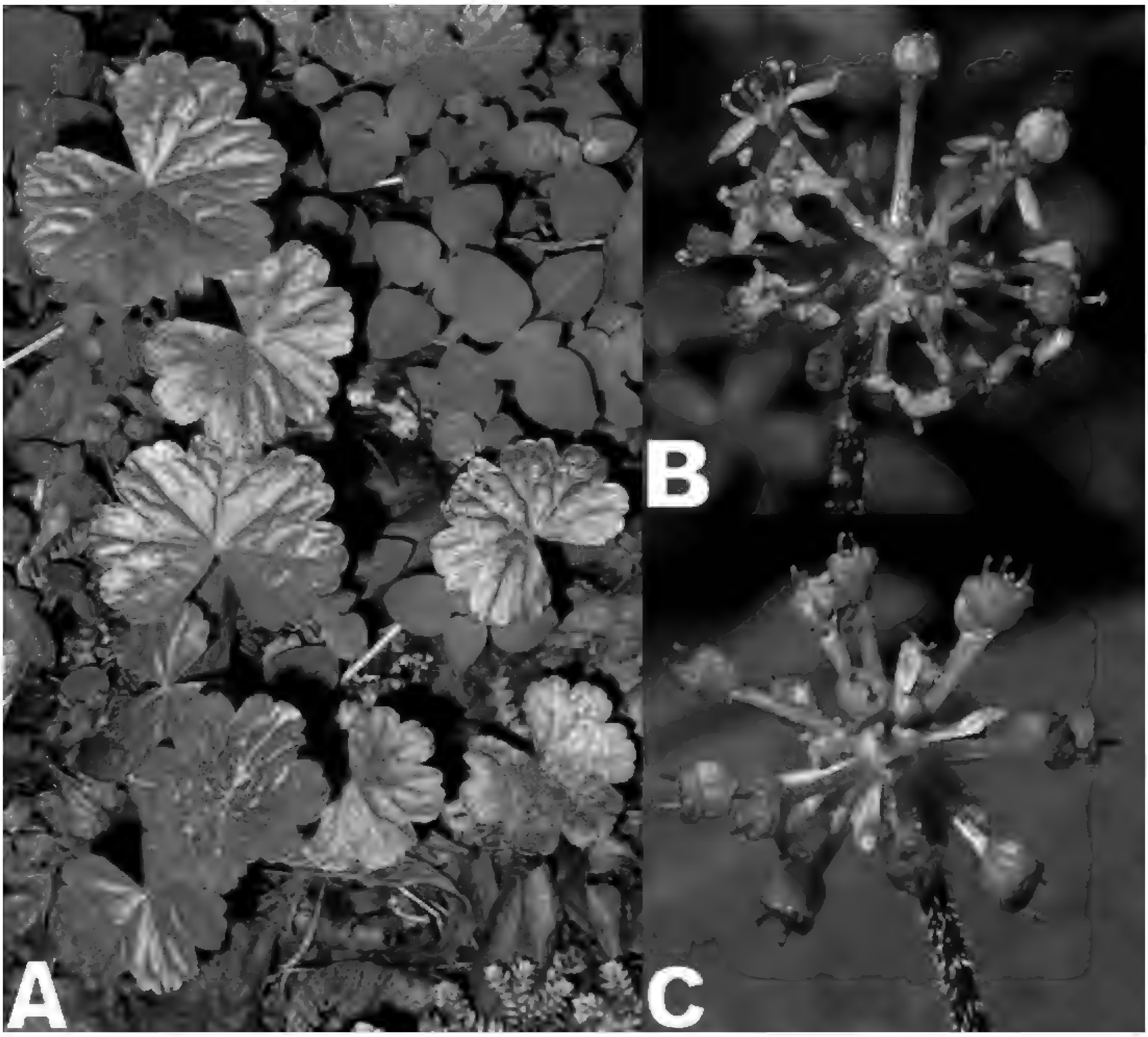


Figura 5. *Hydrocotyle lopeziae* M. Mend. —A. Hábito. —B. Detalle, disposición de flores en infrutescencia. —C. Detalle, brácteas y pelos retrorso-hirsútulos en pedúnculo de infrutescencia. A–C, del tipo *M. Mendoza, D. Santamaría & L. Lagomarcino 3938*.

Distribución y ecología. *Hydrocotyle lopeziae* es considerada endémica a Bolivia, restringida a la zona de Siberia, entre los departamentos de Cochabamba y Santa Cruz, donde se encuentran poblaciones frecuentes aunque dispersas. Se desarrolla en áreas bien conservadas de bosque primario, siempre bajo la protección-sombra de arbolitos y/o arbustos en sotobosque u orillas de bosque, creciendo junto a musgos, pastos o hierbas en lugares muy húmedos o con agua permanente, entre 2500 y 3067 m de altitud.

Categoría de la Lista Roja de UICN. *Hydrocotyle lopeziae* es vista con frecuencia en la zona de Siberia, pero es rara vez recolecta, quizá debido a que normalmente se la encuentra estéril. Este hecho limita poder estimar su distribución y el tamaño de sus poblaciones naturales como para asignarla dentro de una categoría de listas rojas, de acuerdo a criterios de UICN (2011) se plantea como Datos Insuficientes (DD), mientras se realicen estudios más detallados.

Etimología. El nombre de esta especie es dedicada a Mercy Yaneth López Meruvia (1960–), Botánica, Anatomista y Docente de la Universidad Autónoma Gabriel René Moreno, Bolivia, por su dedicación para la formación de nuevos profesionales, compartir sus conocimientos con estudiantes, docentes, investigadores, y continuo apoyo para mi formación profesional.

Discusión. *Hydrocotyle lopeziae* está relacionada con *H. filipes* sobre todo por la forma y pubescencia de sus hojas. Se diferencia por sus láminas profunda

y brevemente divaricadas, lóbulos 3-lobados a lobulado-crenados, estrigoso-hirsutas desde la base al margen en ambas superficies (adaxial, más denso); pedúnculos retrorso-hirsútulos en el ápice; tallos siempre glabros. *Hydrocotyle filipes* presenta láminas suavemente lobadas, lóbulos crenados, enteros a doblemente crenados, glabros a esparcidamente pubescentes; pedúnculos glabros o raramente con esporádicos pelos simples en el ápice y tallos glabros o pubescentes.

Paratipos. BOLIVIA. **Santa Cruz:** Prov. J. M. M. Caballero, al N de Comarapa, 17°52′S, 64°30′W, 2500 m, 3 jun. 1998, *Darius 14* (LPB); Siberia, Laguna Brava y sus alrededores, 17°04′07.9″S, 64°03′07″W, 3067 m, 9 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 632* (K, LPB, MO, NY, USZ); Siberia, Laguna Brava y sus alrededores, 17°04′07.9″S, 64°03′07″W, 3067 m, 9 ago. 2003, *M. Mendoza, D. Santamaría & L. Lagomarcino 3945* (LPB, USZ).

6. Hydrocotyle pusilla A. Rich., Ann. Gen. Sci. Phys. IV: 167, tab. 52, fig. 2. 1820. TIPO: Uruguay. Montevideo: dans les lieux arides des environs, s.d., [P.] *Commerson s.n.* (tipo, P-JU, no visto).

Hydrocotyle costaricensis Rose, J. Wash. Acad. Sci. 17: 195. 1927. TIPO: Costa Rica. San José, on roadside bank near La Palma, 1500–1700 m, 17 July 1923, *W. R. Maxon 7902* (holotipo, US-1180225, no visto).

Hierba rastrera, 10–20(–30) cm, frágil; tallos filiformes con nudos escasamente engrosados, glabros, con manchas cafecinas. Hojas peltadas; estípulas ovadas a suborbiculares, margen usualmente dentado; pecíolos 5–20(–30) mm, retrorso-hirsútulos, más densamente en la inserción laminar, glabrescentes hacia la base, raramente glabros; láminas orbiculares, 0.5–1.5(–2) cm diám., 5 a 8 lobadas; lóbulos crenados, esparcidamente villosos en la superficie adaxial y glabros en la superficie abaxial. Umbelas reducidas, 2 a 6 floras, 2–3.5 mm diám.; pedúnculos no emergentes, menores que los pecíolos, glabros o esparcido-hisútulos hacia la base; brácteas lanceoladas a ovado-lanceoladas, usualmente enteras, ápice agudo; pedicelos filiformes, glabros, reducidos o ausentes, $\leq$ 0.5 mm. Flores con pétalos angular-ovados, rectos a brevemente inflexos, de color amarillo-verdoso o lila suave con manchas oscuras, nervio central no marcado, ápice agudo; estambres con filamentos reducidos, 0.1–0.2 mm, anteras elípticas, amarillas. Frutos transversalmente elípticos, base recta o subcordada, 0.8–1 $\times$ 1.2–1.5 mm, glabros pero arrugados, con manchas rojizas; costillas ausentes u obsoletas; estilopodios obsoletos; estilos persistentes y rectos, hasta 0.3 mm.

Distribución y ecología. *Hydrocotyle pusilla* es una especie ampliamente distribuida en Centro y Sudamérica. En la zona de estudio se presenta en poblaciones relativamente frecuentes pero dispersas. Se desarrolla en áreas de leve a fuerte perturbación y con preferencia al lado de caminos o senderos siempre que tenga buena sombra, crece entre pastos o hierbas y frecuentemente sumergida en agua, entre 2520 y 2800 m de altitud.

Discusión. En la zona de estudio, Bolivia y a nivel global, solo podría ser confundida con *Hydrocotyle adrianae* M. Mend. (aquí descrita). Para diferenciarlas ver discusión de *H. adrianae*.

Adicional material examinado. BOLIVIA. **Santa Cruz:** Prov. J. M. M. Caballero, Siberia, carretera Khara Huasi Comarapa, ca. 8–10 km de Khara Huasi, 17°49′47″S, 64°41′32″W, 2520 m, 9 ago. 2003, *M. Mendoza, M. Nee & D. Vidal 628* (LPB, MO, NY, USZ).

Agradecimientos. A Dios por permitirme el vivir. Al Michael H. Nee (NY), por su confianza, apoyo y enseñanza permanente sobre aspectos taxonómicos, por permitirme acompañarlo en diferentes viajes de campo, estudiar, recolectar parte del material aquí presentado y por hacer posible mi visita al Herbario NY. Al Darwin Iniciative del Gobierno Inglés por financiar el Proyecto: Endemismos de las plantas en los valles centrales andinos de Bolivia (2002–2006) en la persona de John R. I. Wood (K, FHO), como responsable de ejecución del proyecto en Bolivia y que en su momento permitió colectar parte del material aquí presentado, también por su ayuda y guía en el estudio de las Apiaceae de Bolivia y su apoyo con diagnosis en latín. Otro agradecimiento a Steven Churchill, representante del Missouri Botanical Garden (MO) en Bolivia, por su decidido apoyo y empuje para seguir estudiando la taxonomía de *Hydrocotyle* y ayuda para visitar al Herbario MO. Finalmente agradezco al Centro para la Conservación y Desarrollo Sostenible (MO), por hacer posible mi visita y estadía en St. Louis.

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Novelty in *Trigonella* sect. *Ellipticae* (Fabaceae) from Iran

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Abstract. A new species, *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi (Fabaceae), endemic to Ardebil Province in northwestern Iran and belonging to *Trigonella* L. sect. *Ellipticae* (Boiss.) Širj., is described and illustrated. This species is mainly distinguished from *T. elliptica* Boiss. of *Trigonella* sect. *Ellipticae* by some differences such as plant height (41–65 cm vs. 30–40[50] cm), indumentum (sparse to glabrous vs. dense), and fruit shape (lunate vs. erect). *Trigonella elliptica* is selected for comparison with the new species because it is similar to *T. khalkhalica* in fruit characters (the size of pods, sculpturing, and number of seeds) and has a widespread distribution in Iran. The remaining taxa in the section have more restricted distributions. Morphological and anatomical studies on vegetative and floral structures (including pollen, peduncle, stem, and leaf epidermis) are discussed for both species. Variation in some noticeable pollen and anatomical features were observed in the two species. The most significant pollen characters for separating the new species from *T. elliptica* are the polar and equatorial diameters, the colpus interval, and pollen shape. Differential anatomical characters include the stem shape in cross-section and number of sclerenchyma layers, the number of vascular bundles in the stem and peduncle, and also the size and index of stomata in the leaf epidermis.

Key words: Fabaceae, Iran, IUCN Red List, pollen, *Trigonella*.

Fabaceae comprises the subfamilies Caesalpinioideae, Mimosoideae, and Papilionoideae. Papilionoideae has been subdivided into 10 (Rendle, 1952; Willis, 1966) or 31 tribes (Polhill, 1981), depending on the author. Regardless of the classification system, Trifolieae has been consistently recognized within Papilionoideae. Trifolieae includes six genera: *Trigonella* L., *Medicago* L., *Trifolium* L., *Melilotus* (L.) Mill., *Parochetus* Buch.-Ham. ex D. Don, and *Ononis* L. (Heyn, 1981; Lock & Simpson, 1991; Mabberly, 1997). *Trigonella* comprises about 135 species distributed worldwide, mostly in the dry regions of the Mediterranean basin, West Asia, Europe, North and South Africa, North America, and South Australia (only two species) (Mabberly, 1997). In Iran there are 42 taxa in 12 sections localized in different phytogeographical regions, and 13 (39%) of the taxa are endemic (Rechinger, 1984; Hamzeh'ee, 2000; Janighorban, 2004; Badrzadeh & Ghafarzadeh-namazi, 2009; Ranjbar & Hajmoradi, 2012; Ranjbar et al., 2012a, 2012b). Of these endemic taxa, 12 are perennials of *Trigonella* sect. *Ellipticae* (Boiss.) Širj., characterized by having glabrous leaves, stems, and pods, and yellow or occasionally violet flowers (Boissier, 1872; Huber-Morath, 1970).

In recent years the relationships between *Trigonella* species have been explored in various studies (Small et al., 1981, 1990; Brookes & Small, 1988; Al-Habori et al., 1998; Pandita et al., 1999; Hamzeh'ee, 2000; Murakami et al., 2000; Kabilan et al., 2002; Dangi et al., 2004; Janighorban, 2004; Martin et al., 2008, 2011; Ranjbar et al., 2009). However, the anatomical characteristics of the genus have been poorly studied (Ranjbar et al., 2010).

The present study focuses on the analysis of anatomical features, pollen morphology, and morphological characteristics of the new species named here as *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi (*Trigonella* sect. *Ellipticae*). The morphological data were compared between *T. khalkhalica* and *T. elliptica* as a representative of *Trigonella* sect. *Ellipticae*. Among other species of the section, *T. elliptica* is most similar to *T. khalkhalica* in pod characters and also represents a widespread distribution. *Trigonella khalkhalica* is distinguished from *T. elliptica* by differences in plant height, indumentum, and pod shape. In addition, these two species show significant variation in pollen (polar and equatorial diameters, colpus interval, and pollen shape) and anatomical characters (stem shape in cross-section and number of sclerenchyma layers, number of vascular bundles in the stem and peduncle, and the size and index of stomata in the leaf epidermis). These morphological data have proven to be very helpful for distinguishing the new species, which is exclusive to the Ardebil submountainous region.

Materials and methods. This study is mainly based on herbarium material and field observations

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conducted in western, southwestern, and central Iran. Collected materials were deposited at BASU, and specimens were also examined from the following herbaria: FUMH, PR, TARI, W, and WU. Pollen samples were obtained from herbarium specimens and treated according to Erdtman's technique (1960). Treated pollen was mounted on unstained glycerin jelly and observed with a Nikon (Tokyo, Japan) Type-2 microscope. Measurements were based on 25 readings from each studied specimen. Examined pollen characters included the polar axis length, equatorial diameter, colpus length, colpus interval (in granular sites vs. nongranular sites), and pollen shape index (ratio of polar axis length to equatorial diameter).

Anatomical studies, using plant material preserved in glycerin-alcohol (1:1) solution, concentrated on the analysis of cross-sections of peduncles and stems, and also leaflet cuticles and surfaces. For all specimens, 10 hand-cut cross-sections were examined and seven anatomical characters described. The cross-sections were cleared with sodium hypochlorite and diluted acetic acid solution and stained with methylene blue and carmine solutions. Cuticles were obtained by maceration using glycerin-alcohol (1:1) solution, peeled with a razor blade, stained with diluted methylene blue, and mounted in glycerin jelly. Seven epidermal characters from 20 points on both sides of the leaflets were examined and photographed with an Olympus (Tokyo, Japan) BX-41 photomicroscope. Stomata size was estimated from stomata microphotographs digitally analyzed with Carnoy software (Schols et al., 2002).

Trigonella khalkhalica Ranjbar & Z. Hajmoradi, sp. nov. TYPE: Iran. Ardebil: before Ardebil bifurcate to Khalkhal, Kozaj village, 50 km to Khalkhal, 900 m, 3 June 2010, *M. Ranjbar & Z. Hajmoradi 22059* (holotype, BASU; isotype, MO). Figure 1.

Haec species *Trigonellae ellipticae* Boiss. affinis, sed ab ea planta 41–65 (vs. 30–50) cm alta glabra vel sparse (vs. dense) pubescente, foliolis supra glabris (vs. ± utrinque pilosis), pedunculo 1.5–3.9 (vs. 3–7) cm, foliis 3–16 (vs. ca. 3–10) mm, vexillo 9–10 (vs. 7–8[9]) mm, leguminibus glabris (vs. sparse pilosis) lunatis (vs. erectis) exalatis (vs. alatis) differt.

Perennial herbs, to 41–62 cm tall; caudex branched, ± sparsely pubescent, the trichomes 0.2–0.4 mm. Stipules 1–2 × 0.2–0.5 mm, herbaceous, adnate to the petiole for up to 0.5 mm, linear to subulate, densely covered with pubescent trichomes. Leaves 3–16 mm; petiole 2–14 mm; leaflets obdeltoid to obcordate, 4–9 × 2.5–7 mm, truncate or emarginate, abaxially sparsely covered with appressed trichomes, trichomes 0.3–0.5 mm, adaxially glabrous; teeth triangular, with a minute mucron 0.3–0.6 mm; peduncles 1.5–3.9 cm, erect. Racemes loosely 4- to 7-flowered, tip aristate; bracts hyaline-membranous, 0.3–0.5 × 0.2–0.4 mm, deltoid, sparse-glabrous; pedicels 2–6 mm. Calyx 5–6 mm, tubular, ± sparsely covered with short white appressed trichomes, 0.3–0.5 mm, calyx teeth filiform to subulate, ca. 2 mm; corolla yellow; standard 9–10 × 7 mm, elliptic to spheroid, angularly narrowed into the short cuneate claw, rounded at the apex; wings ca. 8 mm; blades oblong, rounded at the apex, 6–6.5 × 2–2.3 mm; auricle 0.5–1 mm; keel ca. 8 mm; keel blades obliquely narrowly triangular-obovate, with straight lower edge and distinctly concave upper edge, acute at the apex, 6 × 3 mm; claw 3–3.2 mm; stamen tube obliquely cut at the mouth; ovary with a stipe ca. 1.5 mm, glabrous. Pods 11–22 × 2.5–4 mm, lunate, with a slender stipe ca. 1 mm, valves straw colored to pale brown, glabrous; seeds 2 to 6.

Pollen morphology. Pollen grains of *Trigonella* sect. *Ellipticae* are elliptic to oblong, often with perforate ornamentation. Some pollen features are common in some species of this section, while others differ. Among the studied characters, the polar axis length, equatorial diameter, and pollen shape index (ratio of polar axis length to equatorial diameter) are occasionally useful in separating closely related taxa in the genus *Trigonella* (Ranjbar et al., 2012a, 2012b). Our results showed that *T. khalkhalica* differs from *T. elliptica* (*Hatami 14331*, BASU) by having oblong pollen (vs. elliptic), longer polar length (31–33 vs. 25–31 μm), and shorter equatorial diameter (16–20 vs. 18–22 μm). Also distinctive is the colpus interval, with *T. khalkhalica* having shorter intervals in granular sites (11–15 μm vs. 12–17 μm) and longer intervals in nongranular sites (9–12 μm vs. 7–9 μm) (Table 1, Fig. 2).

Anatomy. The stem anatomy shows significant differences between *Trigonella khalkhalica* and *T. elliptica* (Table 1; Fig. 2C, E). The stem in *T. khalkhalica* is pentagonal in cross-section (vs. sinuate) and the number of sclerenchyma layers (three or four vs. none to three) and vascular bundles (12 or 13 vs. 15 or 16) differ from those of *T. elliptica*. The peduncle in *T. khalkhalica* and *T. elliptica* is similarly elliptic in outline; however, the new species is distinguished by the parenchyma consisting of spongy cell type (vs. palisade and spongy cell types) and a lower number of vascular bundles (eight vs. 12) (Table 1; Fig. 2D, F). Cell shape and anticlinal cell wall patterns on both sides of the leaflets are almost similar in both species. The cells are sinuate on the adaxial surface and



Figure 1. *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi. —A. Habit, with fruit. —B. Calyx. —C. Standard. —D. Keel. —E. Wings. —F. Ovary. —G. Androecium. Drawn from the holotype, *M. Ranjbar & Z. Hajmoradi 22059* (BASU). Scale bars: A = 2 cm, B–G = 1 cm.

subsinuate on the abaxial side. In both species, leaflets are amphistomatic and represent cruciferous (anisocytic) and ranunculaceous (anomocytic) stomatal types. The stomata index and size for the abaxial and adaxial leaflet surfaces in *T. khalkhalica* are smaller than those in *T. elliptica* (Table 1; Fig. 2).

Distribution and habitat. *Trigonella khalkhalica* is only known from its type locality on the south slopes of the Ardebil heights in Iran. The new species grows in the humid steppes and stony clay terrains of the submountainous regions and around the Kozaj village in South Ardebil Province, Iran.

IUCN Red List category. *Trigonella khalkhalica* is known from one small population, consisting of no more than 15 plants. It was observed to be sparsely scattered near a small village. According to the IUCN

Table 1. Diagnostic morphological, palynological, and anatomical characters of *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi and *T. elliptica* Boiss.

Characters	*T. khalkhalica*	*T. elliptica*
Plant indumentum	sparse to glabrous	dense
Stem length (cm)	41–65	30–40(50)
Leaf length (mm)	3–16	3–10
Leaflet indumentum, abaxial surface	glabrous	loose
Peduncle length (cm)	1.5–3.9	3–7
Corolla standard length (mm)	9–10	7–8
Pod trichomes	glabrous	sparse
Pod shape	lunate	erect
Pod wing	absent	present
Pollen, equatorial diameter (μm, mean)	16 (17.6) 20	18 (19.2) 22
Pollen, polar axis length (μm)	31 (31.85) 33	25 (27.5) 31
Pollen, colpus length (μm)	25 (26.45) 28	18 (21.3) 25
Pollen, colpus interval, nongranular site (μm)	9 (10.4) 12	7 (8.2) 9
Pollen, colpus interval, granular site (μm)	11 (11.05) 15	12 (13.8) 17
Pollen shape index	1.8	1.43
Peduncle parenchyma type	spongy	palisade and spongy
Peduncle vascular bundle number	8	12
Stem sclerenchyma layers	3 or 4	none to 3
Stem vascular bundle number	12 or 13	15 or 16
Stem cross-section shape	pentagonal	sinuate
Stomatal density, adaxial leaflet epidermis (#/mm^2)	16.76	18.32
Stomatal density, abaxial leaflet epidermis (#/mm^2)	13.68	15.43
Stomatal size, adaxial leaflet epidermis (μm)	18.25 × 14.16	20.92 × 16.34
Stomatal size, abaxial leaflet epidermis (μm)	14.47 × 13.11	19.08 × 14.25
Anisocytic stomata, adaxial leaflet epidermis (%)	24.4	35.6
Anisocytic stomata, abaxial leaflet epidermis (%)	29.9	46.9
Anomocytic stomata, adaxial leaflet epidermis (%)	79.3	63.3
Anomocytic stomata, abaxial leaflet epidermis (%)	68.7	53.1
Anomocytic stomata, adaxial leaflet epidermis, with 4 subsidiary cells	92.3	88.1
Anomocytic stomata, adaxial leaflet epidermis, with 5 subsidiary cells	7.7	8.5
Anomocytic stomata, abaxial leaflet epidermis, with 4 subsidiary cells	91.1	74.5
Anomocytic stomata, abaxial leaflet epidermis, with 5 subsidiary cells	8.9	29.4

Red List criteria (IUCN, 2001), this species is classified as Critically Endangered (CR). This category includes taxa with small population sizes that could be at risk.

Etymology. The species is named after the locality of Khalkhal in southern Ardebil Province, Iran.

Taxonomic relationships. *Trigonella khalkhalica* is compared with *T. elliptica* as a representative of *Trigonella* sect. *Ellipticae*. Based on our extensive studies in the field and of herbarium material, we suggest that the characters related to fruit are important diagnostic traits for the perennial species of *Trigonella* sect. *Ellipticae* (Fig. 3). *Trigonella elliptica* is selected for comparison with the new species because it is the only species that shows similarity in fruit characters, such as the size of the pod, sculpturing, and number of seeds, to *T. khalkhalica* and has a widespread distribution in Iran, while other taxa of the section have narrow distributions. *Trigonella elliptica* is commonly found in southern and central Iran, from Fars and Isfahan provinces, while other species, such as *T. aphanoneura* Rech. f. and *T. stenocarpa* Rech. f., occur only in Isfahan and Zahedan provinces, respectively. The new species differs from *T. elliptica* mainly by its plant stature (41–65 cm vs. 30–40[50] cm), the sparse indumentum or glabrousness (vs. dense indumentum) and the pod shape (lunate vs. erect). Further morphological comparison between the two species is presented in Table 1. In addition, *T. khalkhalica* differs from other members of *Trigonella* sect. *Ellipticae* particularly by the lunate pods (Fig. 3). Cross-section shape, type of parenchyma, the number of sclerenchyma layers, and the vascular bundles in stem and peduncle are significant characters that separate the two species from each other. In addition, the polar axis length of the pollen as well as the equatorial diameter and colpus interval especially distinguish the new species.

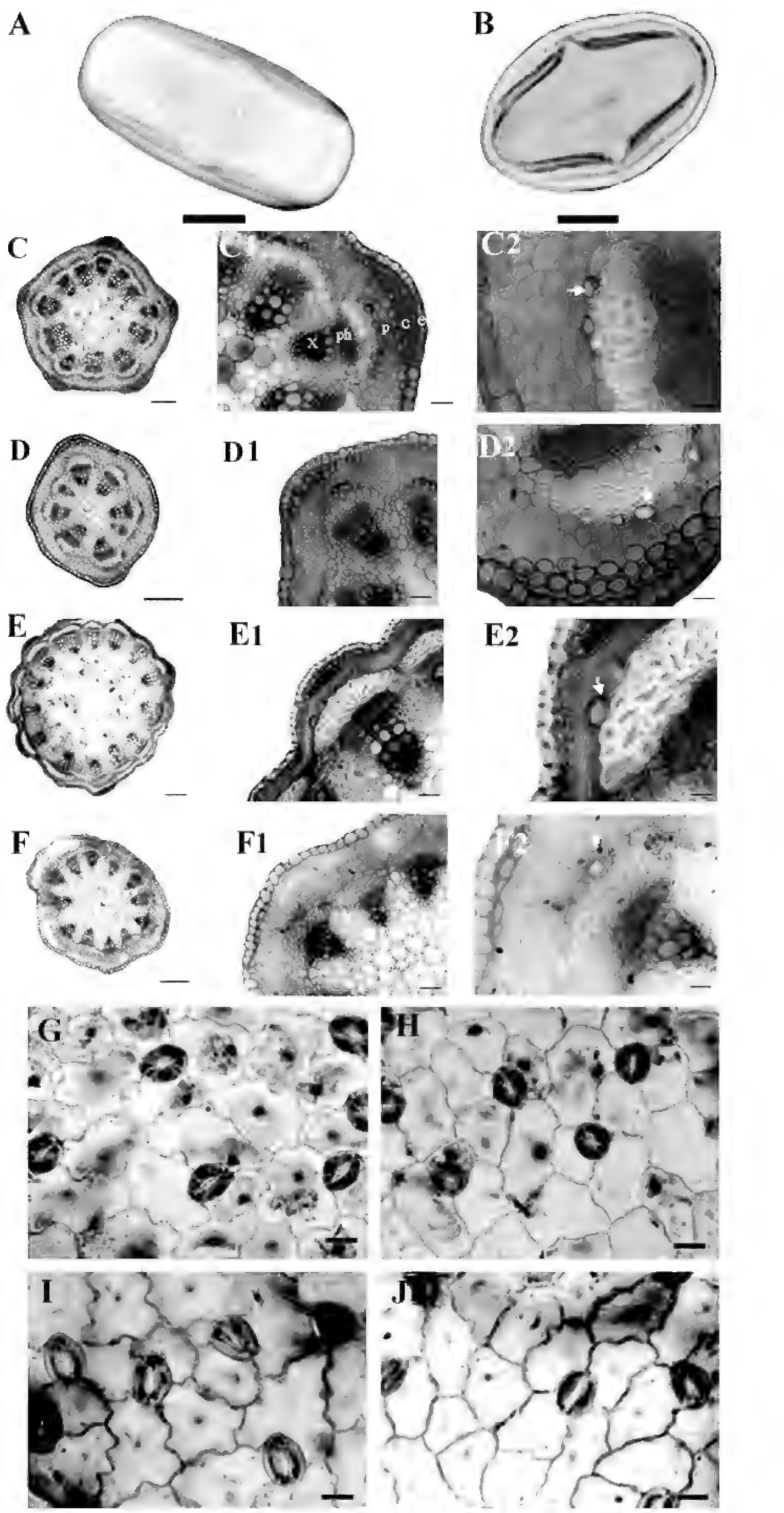


Figure 2. Light micrographs. A, B. Polar views of pollen grains. —A. *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi. —B. *Trigonella elliptica* Boiss. C–F. Cross-sections of stem and peduncle in *T. khalkhalica* and *T. elliptica*. —C. Stem of *T. khalkhalica*. —D. Peduncle of *T. khalkhalica*. —E. Stem of *T. elliptica*. —F. Peduncle of *T. elliptica*. Abbreviations: e = epidermis layer; c = collenchyma layer; p = parenchyma layer; s = sclerenchyma fiber; ph = phloem; x = xylem; arrows in figures indicate crystals. Magnifications in each row from left to right: ×10, ×40, and ×100. G, H. Leaflet epidermis, *T. khalkhalica*. —G. Adaxial surface. —H. Abaxial surface. I, J. Leaflet epidermis, *T. elliptica*. —I. Adaxial surface. —J. Abaxial surface. Scale bars: A–B = 6 μm; C–F = 200 μm; G–J = 12 μm.

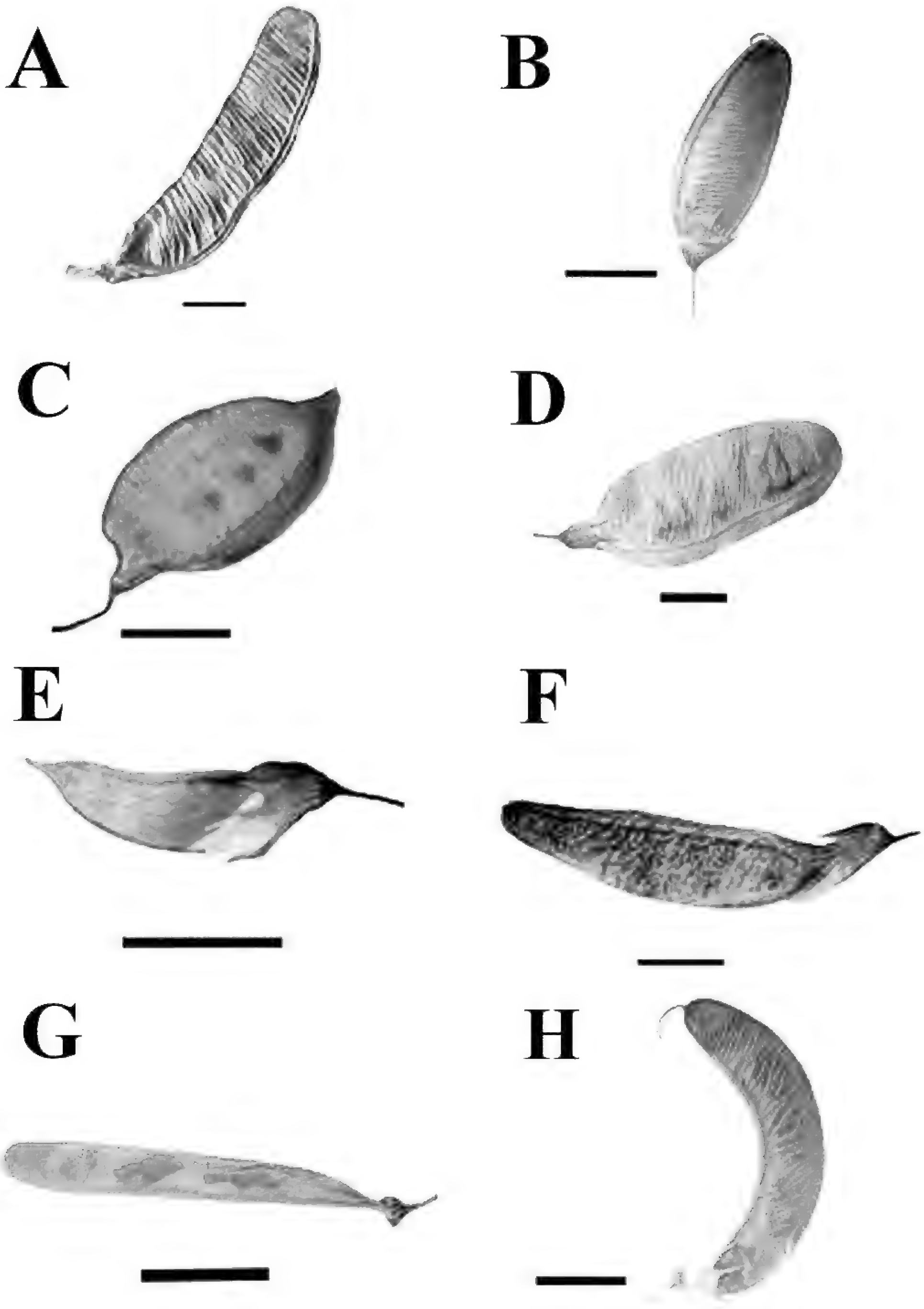


Figure 3. Pod diversity in *Trigonella* sect. *Ellipticae* (Boiss.) Širj. —A. *Trigonella elliptica* Boiss. —B. *Trigonella teheranica* Bornm. —C. *Trigonella disperma* Bornm. —D. *Trigonella latialata* (Bornm.) Vassilcz. —E. *Trigonella subenervis* Rech. f. —F. *Trigonella aphanoneura* Rech. f. —G. *Trigonella stenocarpa* Rech. f. —H. *Trigonella khalkhalica* Ranjbar & Z. Hajmoradi. Scale bars: A–H = 5 mm.

KEY TO THE SPECIES OF *TRIGONELLA* SECT. *ELLIPTICAE* IN IRAN

1a. Pods with wing 2
2a. Pod wing 1–2 mm; pod stipe 1–3 mm ..... *T. latialata* (Bornm.) Vassilcz.
2b. Pod wing 0.5–1.5 mm 3
3a. Pod wing 1–1.5 mm; seed number in pod 1 to 2 ..... *T. disperma* Bornm.
3b. Pod wing 0.5–1 mm; seed number more than 2 4
4a. Pods 8–12(15) × 4–5 mm ..... *T. teheranica* Bornm.
4b. Pods 20–25 × 4–5.5 mm 5
5a. Plants to 40 cm tall, leaflets loosely pilose on upper surface ..... *T. elliptica*
5b. Plants to 54 cm, leaflets glabrous on upper surface 6
6a. Plants loosely pilose except for upper surface of leaflets, flowers 4 to 7 (11) ..... *T. torbatejamensis* Ranjbar
6b. Plants sparsely pubescent to glabrous, flowers 5 to 21 ..... *T. yasujensis* Ranjbar, Z. Hajmoradi & Karamian
1b. Pods without wing 7
7a. Pods lunate ..... *T. khalkhalica*
7b. Pods erect 8
8a. Pods stipitate 9
9a. Corolla yellow-violet; plant densely pubescent ..... *T. lasiocarpa* Ranjbar & Z. Hajmoradi
9b. Corolla yellow; plant glabrous or loosely pubescent 10
10a. Plants glabrous; pods 9.5 × 2.5 mm ..... *T. stipitata* Ranjbar & Joharchi
10b. Plants sparsely to loosely pubescent; pods 20–25 × 3.5–4.5 mm ..... *T. aphanoneura*
8b. Pods sessile 11
11a. Flowers yellow; pods 17 × 3 mm ..... *T. stenocarpa*
11b. Flowers yellowish violet or bicolored 12
12a. Corolla bicolored; leaflets obovate to obcordate, distinctly emarginate at apex ..... *T. binaloudensis* Ranjbar & Karamian
12b. Corolla yellowish violet 13
13a. Plants to 20 cm tall; leaflets 2–6 × 1.5–4 mm ..... *T. heratensis* Rech. f.
13b. Plants more than 20 cm tall 14
14a. Leaflets obovate; flowers (3)5 to 8; pods 9–10(12) × 2–3 mm ..... *T. adscendens* Aphan. & Gontsch.
14b. Leaflets suborbicular; flowers 1 to 3; pods 8 × 3 mm ..... *T. subenervis* Rech. f.

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Taxonomic Novelty and Typifications in *Microlepis* (Melastomataceae)

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Abstract. *Microlepis* (DC.) Miq. (Melastomataceae) is a Brazilian genus originally recognized with four species and four varieties, which occurs in Paraná, São Paulo, Espírito Santo, Rio de Janeiro, and Minas Gerais states, in moist areas of the Atlantic forest and cerrado domains. Its circumscription contains species with opposite and verticillate leaves, multiflorous inflorescences, pentamerous and diplostemonous flowers, the hypanthium and calyx lobes with stellate-tomentose indumentum, the stamens dimorphic, with prolonged connectives and with a ventral biauriculate appendage, and with numerous cochleate seeds. However, morphological studies indicate that this variability is better circumscribed as a single species, *M. oleifolia* (DC.) Triana. Molecular phylogenetic studies in the Melastomeae indicate that *Microlepis* is nested within *Pleroma* D. Don, and therefore the new combination is provided as *P. oleifolia* (DC.) R. Romero & Versiane [≡ *M. oleifolia* (DC.) Miq.]. This is compared to *T. kleinii* Wurdack, which is most similar. The following names are lectotypified: *M. mosenii* Cogn., *M. mosenii* var. *acutifolia* Cogn., *M. oleifolia* var. *angustifolia* Cogn., *M. oleifolia* var. *parvifolia* Cogn., *M. quaternifolia* [var.] β *angustifolia* Cogn., and *M. trianae* Cogn.

Resumo. *Microlepis* (DC.) Miq. (Melastomataceae) é um gênero brasileiro originalmente reconhecido com quatro espécies e quatro variedades, as quais ocorrem nos estados do Paraná, São Paulo, Espírito Santo, Rio de Janeiro e Minas Gerais, em áreas úmidas dos domínios Atlântico e Cerrado. Sua circunscrição original contém espécies com folhas opostas e verticiladas, inflorescências multifloras, flores pentâmeras e diplostêmones, hipanto e lacínias do cálice com indumento estrelado, estames dimórficos com conectivo prolongado e com um apêndice ventral biauriculado. Contudo, estudos morfológicos indicam que esta variabilidade é melhor circunscrita a uma única espécie, *M. oleifolia* (DC.) Triana. Os estudos moleculares recentes em Melastomeae indicam que *Microlepis* está inserido no gênero *Pleroma* D. Don e por isso é fornecida a nova combinação *P. oleifolia* (DC.) R. Romero & Versiane [≡ *M. oleifolia* (DC.) Miq.]. Esta é comparada com *T. kleinii* Wurdack, com a qual é mais similar. Os seguintes nomes são lectotipificados: *M. mosenii* Cogn., *M. mosenii* var. *acutifolia* Cogn., *M. oleifolia* var. *angustifolia* Cogn., *M. oleifolia* var. *parvifolia* Cogn., *M. quaternifolia* [var.] β *angustifolia* Cogn., e *M. trianae* Cogn.

Key words: Brazil, Melastomataceae, *Microlepis*, *Pleroma*, *Tibouchina*.

The Melastomataceae Juss. comprises approximately 4600 species in about 170 genera (Clausing & Renner, 2001). The Melastomeae, Miconieae, and Microlicieae are the most diverse tribes in Brazil (Romero, 2003). The species included in the Melastomeae possess prolonged anther connectives, pubescent ovary apices, and cochleate seeds (Renner, 1994). Within the Melastomeae, *Microlepis* (DC.) Miq. has been morphologically distinguished by opposite or verticillate leaves, multiflorous inflorescences, pentamerous and diplostemonous flowers, the hypanthium and calyx lobes with stellate indumentum, dimorphic stamens with prolonged connectives, with a ventral biauriculate appendage, and by numerous cochleate seeds (Miquel, 1840; Hooker, 1867; Baillon, 1879; Cogniaux, 1885, 1891).

Among the Neotropical genera of the Melastomeae, *Microlepis* is most similar to *Tibouchina* Aubl., being distinguished by the isomorphic or subisomorphic stamens, with a prolonged connective below the thecae with truncate or biauriculate ventral appendage (Cogniaux, 1885, 1891). In the most recent taxonomic revision of *Microlepis*, Cogniaux (1891) recognized four species and four varieties. However, the component species were tenuously delimited, and morphological characteristics have frequently overlapped. Analysis of the type collection has allowed lectotypifications and recognition of new synonyms. Furthermore, molecular phylogenetic studies indicate that *Microlepis*, together with *Itatiaia* Ule, *Svitramia* Cham., and *Tibouchinopsis* Markgr., nest within *Pleroma* D. Don, genera previously synonymized under *Tibouchina* (Michelangeli et al., 2013), and therefore we provide a new combination.

Materials and Methods

This study is based on an analysis of ca. 140 specimens of *Microlepis* deposited at BHCB, BR,

CESJ, ESA, F, G, HRCB, HUFU, HXBH, K, M, MBM, NY, OUPR, PAMG, RB, SP, SPF, VIC, and W. The digital images of types in the virtual herbaria of F, K, and NY were analyzed and are also included among the examined material. We have adopted the morphological terminology used by Radford (1986) and the indumentum terminology used by Wurdack (1986). Data on flowering, fruiting, and geographical distribution were collection based and plotted on a map using ArcView GIS. The program MapSource and GoogleEarth were used to obtain the geographic coordinates for the specimens examined.

Taxonomic History

Microlepis was originally established as a section of *Osbeckia* L., with four species accepted by de Candolle (1828), among them *O. oleifolia* DC., with one variety further distinguished for this species as *O. oleifolia* β *quaternifolia* DC. *Osbeckia* sect. *Microlepis* DC. circumscribed American species with an ovate to oblong hypanthium, with the apex constricted and urceolate near the apex, and five caducous, slightly ciliate calyx lobes. The name *Microlepis* (*micros*, meaning "small," and *lepis*, meaning "scales") refers to the long stellate trichome between each of the lobes of the calyx (Don, 1832).

Martius (1829) subsequently transferred *Osbeckia oleifolia* to *Lasiandra* DC., a genus distinguished by opposite or verticillate leaves, terminal inflorescences, pentamerous and diplostemonous flowers, with violet or purple petals, a caducous bract pair, calyx with five lobes, dimorphic stamens with prolonged connective and a biauriculate ventral appendage. The majority of species of *Lasiandra* recognized by Martius (1829) were later placed in *Tibouchina* by Baillon (1877) and Cogniaux (1885).

Don (1832) accepted the previous treatment by de Candolle (1828) and for the first time mentioned that the sections *Chaetolepis* DC., *Microlepis* DC., *Pterolepis* DC., and *Osbeckiaria* DC. of *Osbeckia* should be segregated into several genera. As suggested by Don (1832), Miquel (1840) recognized *Microlepis* as a distinct genus with the species restricted to Brazil but did not publish the transfer of species. Later Miquel (1849) would consider de Candolle's variety *quaternifolia* (*O. oleifolia* β *quaternifolia*) within *Microlepis* at the rank of species. Naudin (1850) established the segregate genus *Ancistrodesmus* Naudin in Lasiandrales on the basis of the single species *A. oleifolius* Naudin.

Triana (1873) transferred de Candolle's species as *Microlepis oleifolia* (DC.) Triana and accepted its variety at species rank, as proposed by Miquel (1849). It is noteworthy that Triana (1873) indicated two collections for *M. oleifolia*, a Martius collection from São Paulo as similarly cited by de Candolle (1828) and the additional collection from Minas Gerais, *Guillemin 567*. Cogniaux (1885) accepted *M. oleifolia* and elevated de Candolle's variety as *M. quaternifolia* (DC.) Cogn. Cogniaux (1885) did not refer to Miquel's earlier 1849 name *M. quaternifolia*, which was the prior name at species rank. Cogniaux (1885) further described three varieties within *M. oleifolia* and established two new species, *M. trianae* Cogn. and *M. mosenii* Cogn., the latter with one new variety, *M. mosenii* var. *acutifolia* Cogn. Later, Cogniaux (1891) considered *Microlepis* with four species and four varieties.

Pleroma oleifolia (DC.) R. Romero & Versiane, comb. nov. Basionym: *Osbeckia oleifolia* DC., Prodr. 3: 139. 1828, as "*oleaefolia*." *Lasiandra oleifolia* (DC.) Mart., Nov. Gen. Sp. Pl. 3: 97, tab. 244. 1829, as "*oleaefolia*." *Microlepis oleifolia* (DC.) Triana, Trans. Linn. Soc. 28: 36. 1873, as "*oleaefolia*." TYPE: Brazil. São Paulo: "campis sicceis elatioribus in valle flum. Paraiba et prope Lorena," s.d., *C. F. P. Martius s.n.* (holotype, M, M photo at G). Figure 1.

Microlepis quaternifolia (DC.) Miq., Linnaea 22: 541–542. 1849, syn. nov., non *Microlepis quaternifolia* (DC.) Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 236. 1885, nom. illeg. Basionym: *Osbeckia oleifolia* [var.] β *quaternifolia* DC., Prodr. 3: 139–140. 1828. TYPE: Brazil. Minas Gerais: "campis et ad latera sylvarum locis altis passim," s.d., *C. F. P. Martius s.n.* (holotype, M, M photo at G; isotype, G).

Ancistrodesmus oleifolia Naudin, Ann. Sci. Nat., Bot., sér. 3, 13: 302. 1850, as "*oleaefolius*." TYPE: Brazil. "In Brasiliae provincia Sancti Pauli," 1849, *J. A. Guillemin 567* (holotype, P).

Microlepis mosenii Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 235–236. 1885, syn. nov. TYPE: Brazil. Minas Gerais: "campo sicco aprico ad Caldas et inter Serra de Caracol et cerrado," s.d., *C. W. H. Mosen 1275* (lectotype, designated here, BR; isolectotypes, K, P).

Microlepis mosenii [var.] β *acutifolia* Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 236. 1885, syn. nov. TYPE: Brazil. Minas Gerais: *J. F. Widgren 991* (lectotype, designated here, BR; isolectotype, P).

Microlepis oleifolia [var.] β *angustifolia* Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 238. 1885, syn. nov. TYPE: Brazil. São Paulo: "locis humidis ad Pirituna, Prates prope Castro," s.d., *L. Riedel 292* (lectotype, designated here, BR; isolectotype, LE).

Microlepis oleifolia [var.] γ *parvifolia* Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 238. 1885, syn. nov. TYPE: Brazil. São Paulo, s.d., *F. Sello[w] 5743* (lectotype, designated here, K).

Microlepis quaternifolia [var.] β *angustifolia* Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 237. 1885, syn. nov. TYPE: Brazil. São Paulo: locis humidis paludosique prope Ypanema, s.d., *L. Riedel 2159* (lectotype,

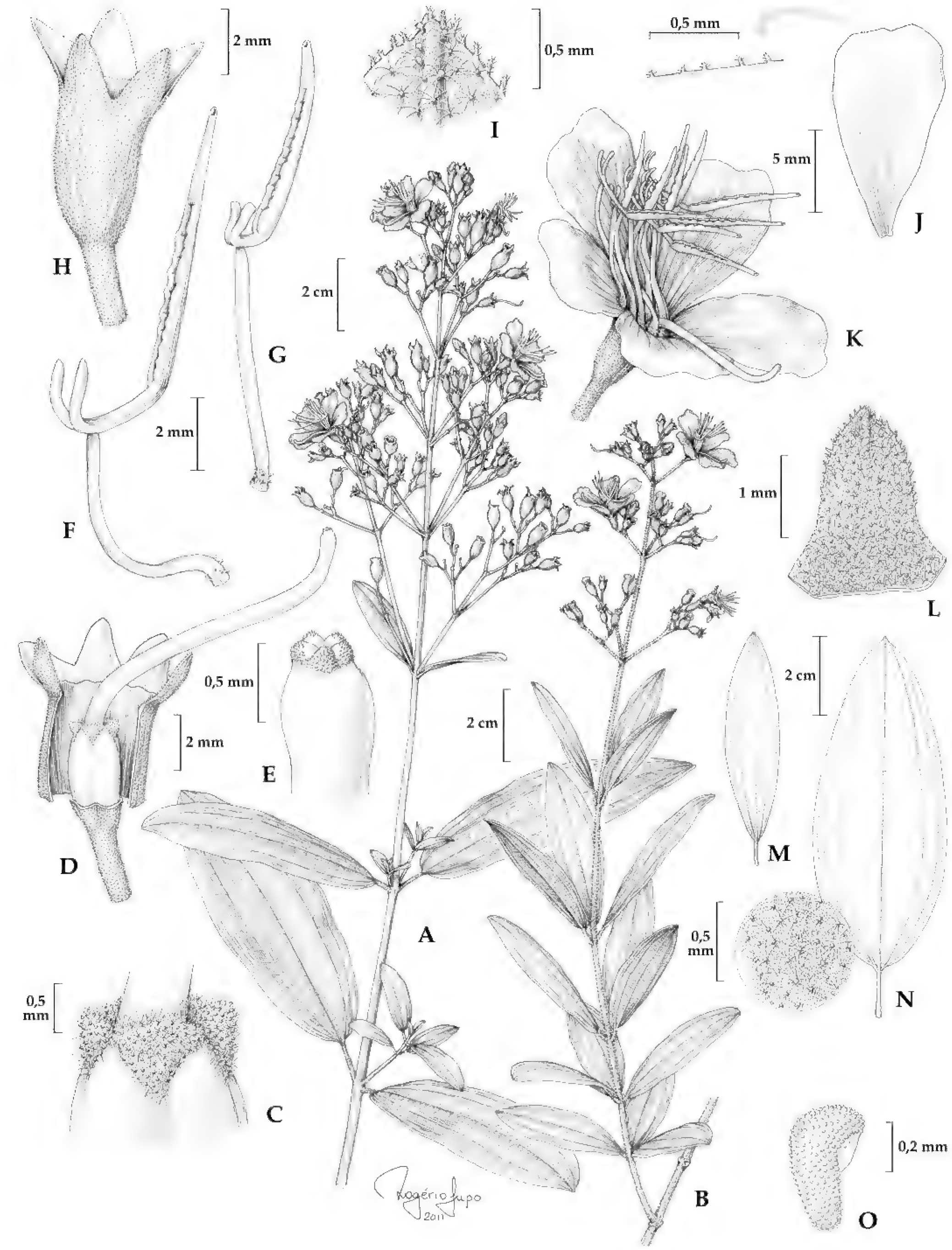


Figure 1. *Pleroma oleifolia* (DC.) R. Romero & Versiane. —A. Flowering branch with paired, opposite leaves. —B. Fertile branch with verticillate leaves of three per whorl. —C. Ovary apex, showing the apical indument. —D. Gynoecium. —E. Stigma. —F. Larger stamen, lateral view. —G. Smaller stamen, lateral view. —H. Hypanthium. —I. Calyx lobe, showing apex and indument. —J. Petal, with detail of ciliate-stellate margin at left. —K. Flower. —L. Calyx lobe, abaxial surface with dense indument. –M, N. Leaves. —M. Abaxial blade surface. —N. Abaxial blade surface, with close-up of indument at left. —O. Seed. A, C, D, E, H–L, and N are from *J. N. Nakajima et al. 897* (HUFU); B is from *J. Matos 15766* (SP); F, G, and O are from *J. N. Nakajima et al. 1650* (HUFU); M is from *G. Hatschbach 50899* (MBM).

designated here by V. I. Dorofeyev, LE; isolectotypes, BR, M).

Microlepis trianae Cogn., in Mart., Eichler & Urban, Fl. Bras., 14(3): 238. 1885, as "*Trianaei*," syn. nov. TYPE: Brazil. Minas Gerais: "montosis ad aquas prope Alto do Morro, inter Villa Rica et Ouro Branco," s.d., *J. B. E. Pohl 1281* (lectotype, designated here, K; isolectotype, NY).

Erect subshrubs or shrubs, 0.7–3 m tall; branching dichotomously in upper half; branches terete, triangular or quadrangular, flattened proximal to inflorescence, sometimes striate; young branches and petioles covered with stellate and dendritic long-pedunculate trichomes. Leaves opposite, rarely verticillate, 3 or 4 per node or opposite and verticillate on same branch; leaf blades 2.5–10.5(–12) × 0.7–4 cm, chartaceous, discolorous, adaxial surface dark brown (ex sicc.), abaxial surface pale brown, lanceolate to ovate-lanceolate, base rounded to slightly attenuate, apex acute to acuminate, margin entire to slightly crenulate, indumentum on adaxial surface sparse to dense, dendritic and stellate trichomes, rarely adpressed, trichomes early caducous, indumentum on abaxial surface denser, tomentose-dendritic and stellate trichomes, 4-nerved from base, rarely 2- or 6-nerved and then with inconspicuous lateral veins covered with dendritic and stellate trichomes; petioles 2–20 mm. Inflorescence a thyrse, terminal or lateral, 6–27 cm, multiflorous; bracts 7–10 × 3–7 mm, concave-triangular, brownish (ex sicc.), adaxial surface densely stellate, abaxial surface glabrous, bracteoles 4–10 × 2–5 mm, narrowly triangular, brownish (ex sicc.), adaxial surface sparse to moderately stellate, abaxial surface glabrous. Flowers 5-merous; pedicels 2–5 mm, terete to slightly flattened, tomentose-dendritic pubescent; hypanthium 3–6.5 × 2–3 mm, oblong to oblong-campanulate, moderately to densely stellate-tomentose; calyx lobes 1–2.5 × 0.5–1.5 mm, caducous in fruit, triangular to oblong-triangular, adaxially glabrous, abaxially usually stellate-tomentose, margin ciliate or not, calyx surfaces occasionally stellate-tomentose, margin entire, ciliate-stellate, apex sometimes with a conspicuous dendritic trichome, a single dendritic trichome between the lobes, 0.1–0.4 mm; petals 6–14 × 3–7 mm, purple, obovate-oblong to oblong, apex rounded, base slightly attenuate, margin entire, ciliate-stellate; stamens 10, dimorphic; larger stamens 5, filaments 7.5–10 mm, with glandular trichomes at the base, or glabrous, anthers 5–8 mm, tetrasporangiate, base purple, apex cream, sometimes entirely cream, apex attenuate, connective prolonged 2–4 mm below the thecae, purple, biauriculate ventral appendage 1.5–3 mm long, purple; smaller stamens 5, filaments 4–8 mm, glandular trichomes at the base, or glabrous, anthers 3.5–6 mm, tetrasporangiate, cream, sometimes purple at the base, apex cream, attenuate, connective prolonged 0.2–1 mm below the thecae, cream, biauriculate ventral appendage 1–2 mm, cream; ovary 5-locular, 1/2 inferior, apex 5-lobed with adorned dendritic trichomes; style purple, 4–12 mm, apex slightly curved, sometimes with sparse stellate trichomes at the base, stigma 5-lobed. Capsule 3.5–8 × 2–5 mm, dehiscence loculicidal, seeds 0.4–0.6 × 0.1–0.3 mm, numerous, cochleate, tuberculate.

Cogniaux (1885: 236) noted two collections for *Microlepis mosenii*, both from Minas Gerais. The first so cited was from the Serra de Caldas and was noted as "Regnell n. I. 155 in herb. Holm. [Stockholm]"; we saw this collection at K and NY. The second collection cited was *Mosen 1275*, from Caldas, between Serra do Caracol and Cercado, which we saw in BR. It corresponds perfectly with the protologue and is selected herein as the lectotype of *M. mosenii*.

Cogniaux (1885: 236) noted two syntypes for *Microlepis mosenii* var. β *acutifolia*. The first of these was the collection *Lindberg 330*, which was noted to be at "herb. Brux. et Holm. [Stockholm]" and which we saw at BR. The second syntype was the collection *Widgren 991*, noted to be at BR, which corresponds to the original description and is herein selected as the lectotype.

Cogniaux (1885: 238) mentioned two collections for *Microlepis oleifolia* var. *angustifolia*, both by Riedel, numbered collections *292* and *2072*. The collection *Riedel 292* consists of a single sheet at BR with fertile material, without Cogniaux's determination, but it has a label from Herbier Alfred Cogniaux and matches with the protologue of the species. The collection *Riedel 2072* was not located at BR, so the representative collection *Riedel 292* is designated herein as the lectotype.

Cogniaux (1885: 238) described *Microlepis oleifolia* var. *parvifolia* based on the two syntypes *F. Sello[w] 481* and *F. Sello[w] 5743*. Both collections were qualified after their citation in the protologue with the word "part." after the Sellow collection numbers. The sheet at K (*F. Sello[w] 5743*) was a duplicate from B, which was destroyed during World War II. The K sheet has only one fertile branch and a label handwritten by Cogniaux that notated *M. oleifolia* γ *parvifolia* Cogn. Hence the specimen *F. Sello[w] 5743* is designated here as the lectotype of *M. oleifolia* var. *parvifolia*, since the vegetative and reproductive parts agree with the protologue descrip-

tion and certainly were seen by Cogniaux. The syntype *F. Sellow 481* has not been located.

In the protologue of *Microlepis quaternifolia* [var.] β *angustifolia*, Cogniaux (1885: 237) indicated that the collection *L. Riedel 2159* was deposited in herbaria "Petrop., Monac., Vindob. et Brux." (LE, M, W, and BR, respectively). The specimen *L. Riedel 2159* at LE is designated here as the lectotype of *M. quaternifolia* [var.] β *angustifolia*, since it is in good condition, the characteristics agree with the protologue of the species, and the sheet has Cogniaux's determination. The type designation credits V. I. Dorofeyev's in sched. selection of this sheet as the lectotype.

Microlepis trianae was described by Cogniaux (1885: 238–239) from several syntypes, with three specimens collected between Ouro Preto (old Villa Rica) and Ouro Branco (*Pohl 412*, *Pohl 1281*, and *Pohl 3685*) and another from Caxoeira do Campo (*Lund s.n.*). Only *Pohl 412* was not located by the authors. The material collected as *Pohl 1281* (K) agrees perfectly with the protologue and is selected as the lectotype of *M. trianae*.

Phenology. Flowers were collected from December to October, and fruits were collected from February to May and in October and December.

Distribution and habitat. *Pleroma oleifolia* is distributed through Paraná, São Paulo, Espírito Santo, Rio de Janeiro, and Minas Gerais states (Fig. 2). Although it has also been cited from Rio de Janeiro (Cogniaux, 1891; Romero, 2010), we could not confirm any collection from the state. Cogniaux (1891) related the collection *Glaziou 12691* to Rio de Janeiro without indicating the locality. According to Wurdack (1970), some geographical changes were made by Glaziou on specimen labels, and we believe the occurrence in Rio de Janeiro to be erroneous. Nevertheless, there is a record from Serra da Bocaina, on the border of São Paulo and Rio de Janeiro states (Fig. 2), and it is possible that its occurrence also extends to Rio de Janeiro. *Pleroma oleifolia* occurs mostly along the margins of streams as well as in wet places or marshes adjacent to high-altitude rocky fields (campos rupestres), cerrado, and Atlantic forest.

The species and varieties of *Microlepis* have been distinguished on the basis of the position of the leaves on the branches, the number of leaf veins, and the density of trichomes on both the branches and leaves. Our analysis of specimen and type collections indicates that these morphological characters are quite variable. Individuals frequently possess opposite, but rarely three to four verticillate leaves. Some specimens collected from the states of Minas Gerais (*M. Barreto 6865*, *A. P. Duarte 7651*, *A. C. Brade 17779*, *J. P. Carauta 2294*, *M. Brandão 29015*, *W. A. Teixeira s.n.*, *C. F. P. Martius s.n.*, *F. Regnell I 155*, *J. B. E. Pohl 1281*, and *H. Lindberg 330*, all herbaria of deposit indicated elsewhere) and São Paulo (*L. Riedel 2159*, the type of *M. quaternifolia* var. *angustifolia* Cogn.; and *A. F. M. Glaziou 2329*) possess three verticillate leaves. We have observed four verticillate leaves only in *Martius s.n.*, which is the type for *M. oleifolia* var. *quaternifolia*. The specimen *J. F. Widgren 991* (the lectotype of *M. mosenii* var. *acutifolia*) has three and four verticillate leaves on the same individual. Other characteristics of the hypanthium, calyx lobes, and stamens are consistent and show little variation among individuals. Taxonomic delimitation based on vegetative characters is tenuous and does not support the separation between species and varieties. *Pleroma oleifolia* can be recognized by the indumentum (of stellate and dendritic long-pedunculate trichomes) on the branches and both leaf blade surfaces, by the hypanthium and calyx lobes characterized by dendritic and stellate-tomentose indumentum, as well as by the dimorphic stamens with a biauriculate ventral appendage.

Pleroma oleifolia resembles *Tibouchina kleinii* Wurdack (1962: 124), which occurs in Santa Catarina (Wurdack, 1962; Guimarães, 2013) and Paraná (Meyer et al., 2010). Both have opposite or verticillate leaves, a terminal or lateral thyrse, purple petals, dimorphic stamens, and filaments and style with glandular trichomes. The indumentum of dendritic and stellate trichomes on both surfaces of the leaves, and stellate trichomes on the hypanthium, the small stamens with slightly prolonged connectives (0.2–1 mm), and with a ventral biauriculate appendage distinguish *P. oleifolia* from *T. kleinii*, which has strigose trichomes on the adaxial surface of the leaf and glandular trichomes on the hypanthium, the small stamens with prolonged connectives (1–2 mm), and a bilobed appendage. The inconspicuously and irregularly ciliate-serrulate margins of the leaves of *T. kleinii* are also noticeably different from those of *P. oleifolia*, which are entire to slightly crenulate.

Specimens examined. BRAZIL. s. loc., *E. Warming s.n.* (BR); *A. Usteri s.n.* (BR); *C. F. P. Martius 1827* (G); *F. Sellow s.n.* (BR). **Espírito Santo:** Castelo, *A. C. Brade 19186* (RB). **Minas Gerais:** Ayuruoca, *A. F. M. Glaziou 15970* (BR); entre Ayuruoca e Cachambú, *A. F. M. Glaziou 17524* (BR); Bom Jardim de Minas, Serra da Mira, *J. P. P. Carauta 2294* (HUFU); Cachoeira do Campo, *J. Badini 1975* (OUPR, PAMG); Camanduacaia, Serra da Mantiqueira, *L. D. Meireles et al. 885* (RB); Catas Altas, Parque Nat. Caraça, trilha para Cascatinha, *R. Romero & J. N. Nakajima 5984* (HUFU); entre Chapada e Ouro Preto, *J. Badini 1975* (OUPR); Faz. Macaquinhos, *J. Badini 1974* (OUPR); Ouro

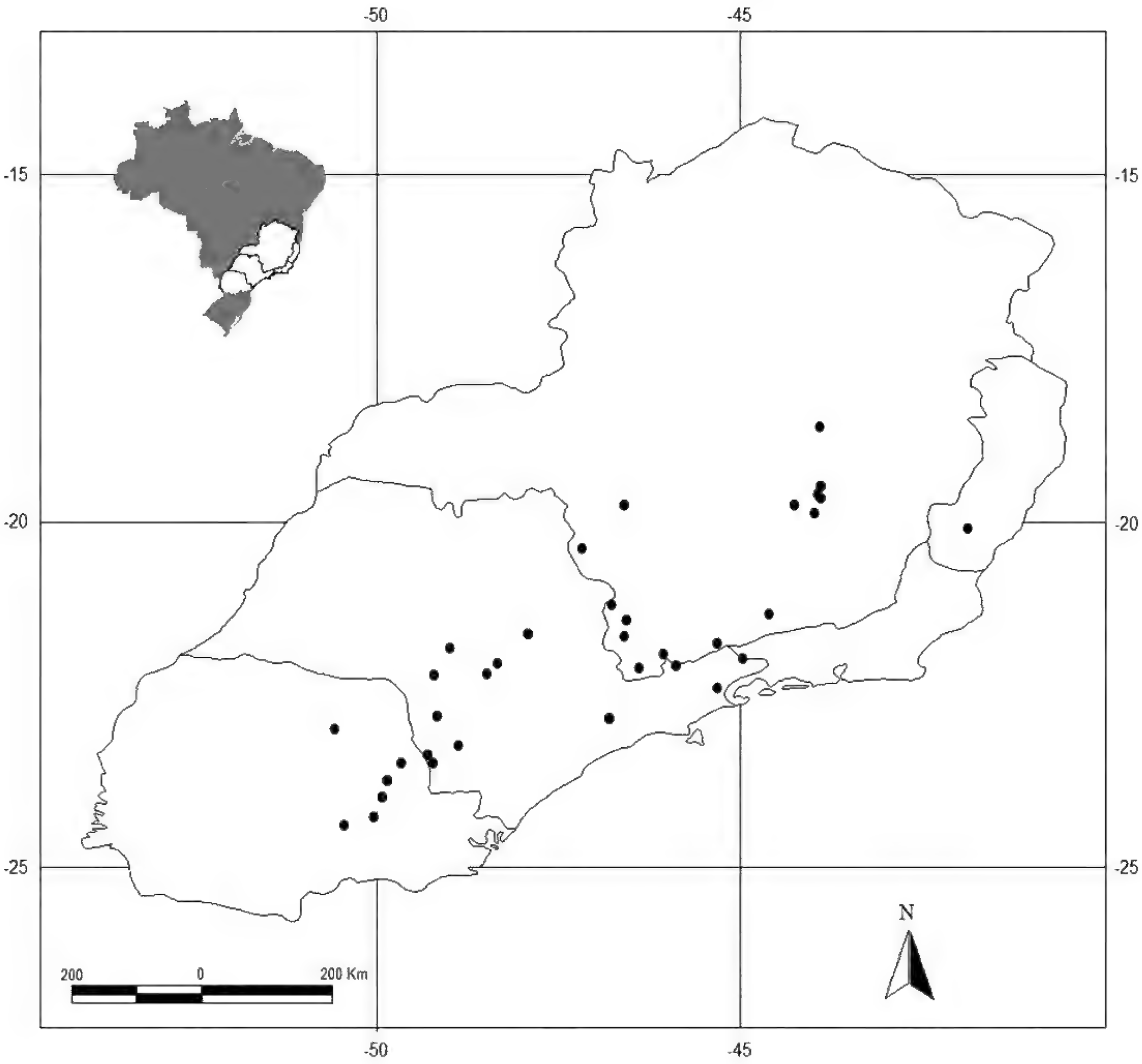


Figure 2. Distribution of *Pleroma oleifolia* (DC.) R. Romero & Versiane in Brazil.

Fino, *F. C. Hoehne 1927* (SP); Ouro Preto, Base do Itatiaia, *J. Badini 1975* (OUPR); Ouro Preto, Três Moinhos, *J. Badini 1975* (OUPR), *J. Badini et al. 1975* (OUPR); Paraisópolis, *F. C. Hoehne 1927* (SP); Passa Quatro, Faz. Campos, *J. F. Zikán 21* (SP); Passa Quatro, Sertão dos Martins, *A. C. Brade & S. Araújo 19038* (RB); Pico do Itabirito, *W. A. Teixeira 1995* (BHCB, HUFU); Poços de Caldas, *F. C. Hoehne 1920* (SP); Santa Bárbara, Caraça, *M. Barreto 6865* (BHCB, MBM, SP); Santa Rita de Caldas, Rod. Ipuiuna-Poços, *M. Brandão 29015* (HUFU, PAMG); São Roque de Minas, estr. para Sacramento próx. ao córrego dos Passageiros, Parque Nac. Serra da Canastra, *J. N. Nakajima et al. 897* (HUFU, NY), *J. N. Nakajima & R. Romero 1650* (F, HUFU), *R. Romero & J. N. Nakajima 3494* (BHCB, F, HUFU); São Sebastião do Paraíso, Faz. Calado, *A. C. Brade & A. Barbosa 17779* (RB); Serra do Caraça, *E. Pereira 2559* (RB); Serra do Caraça, Barão de Cocais, *H. S. Irwin et al. 1971* (NY); Serra do Caraça, *J. Badini 1974* (OUPR); Serra do Caraça, Cascatinha, *J. Badini 1984* (OUPR); Serra do Caraça, caminho para Cascatinha, *M. B. Horta et al. 319* (BHCB); Serra do Cipó, Km. 133, *A. P. Duarte 7651* (RB). **Paraná:** Castro, Socavão, *C. Stellfeld 1144* (MBM, RB), *G. Hatschbach & H. Haas 13924* (MBM); Imbituva, *G. Hastchbach 12519* (MBM); Jaguariaiva, Km. 168, *R. Kummorow 450* (MBM), Rio Cilada, *G. Hatschbach & A. Souza 50899* (BR, MBM); Morungava, *P. Dusén 1915* (G); Piraí do Sul, Joaquim Murtinho, *G. Hatschbach 18803* (MBM); Piraí do Sul, *G. Hatschbach 39934* (MBM), *G. Hatschbach et al. 69043* (G, HUFU, MBM); Ponta Grossa, Arroio Guaviroba, Parque Vila Velha, *G. Hatschbach 31777* (MBM); Rod. PR-11, Piraí do Sul, *G. Hatschbach et al. 54063* (HXBH, MBM); São Jerônimo da Serra, Rio do Tigre, *G. Hatschbach 3627* (MBM). **São Paulo:** Águas de Santa Bárbara, Est. Ecol. Santa Bárbara, *J. A. A. M. Neto et al. 763* (HUFU, VIC); Agudos, Faz. Comp. Cervejaria Brahma, *P. F. Assis 15* (SP); Botucatu, próx. aeroporto, na estrada do Reserv. Botucatu, *I. Gottsberger 136375* (MBM); Botucatu, ca. 4 km do Rio Tietê, próx. Faz. Relâmpago, *V. C. Souza et al. 11321* (SP); Campo da Bocaina, *A. F. M. Glaziou 2329* (BR); Campos do Jordão, *P. C. Porto 3177* (HUFU), *L. Lanstyack 1937* (RB), *K. D. Barreto et al. 1075* (ESA), *J. Matto 15766* (SP), *M. J. Robim et al. 252* (SP), *M. J. Robim 398* (SP), *M. J. Robim 542* (SP), *G. J. E. Leite 3321* (RB), *M. J. Robim 743* (MBM), *M. J. Robim 540* (SP); Cunha, Parque

Est. Serra do Mar, estr. acesso ao Núcleo, *J. B. Baitello 425* (SP); Itapeva, Est. Ecol. Itapeva, *S. C. Chiea et al. 692* (SP); Itararé, Faz. Espinho, *V. C. Souza 3232* (ESA, MBM); Itararé, Ribeirão Carcará, *Francisconi et al. 1995* (HUFU, SP); Itirapina, *M. A. Assis et al. 1138* (HUFU, RB), *M. A. Assis et al. 1150* (HUFU, MBM), *J. L. S. Tannus 571* (HRCB, HUFU); Mogi das Cruzes, *A. Gehrt 1921* (SP), *G. Hashimoto 1938* (SP); São Paulo, *F. Frazão 1917* (HUFU); Freguesia do Ó, *A. Usteri 1906* (SP); Móoca, *A. C. Brade 6061* (SP); Guatemim, *F. C. Hoehne 1918* (SP), *F. C. Hoehne 1919* (SP); Butantã, *J. King 6* (SP); Vila Cerqueira César, *W. Hoehne 1933* (HUFU, SPF); Vila Mariana, *A. C. Brade 13039* (RB); Jardim América, *M. Kuhlmann 1935* (SP); Ave. 9 de Julho, *M. Kuhlmann 1940* (SP); Santo Amaro, *L. Krieger 5* (SP), *L. Krieger 1942* (CESJ); Butantã, *A. B. Joly 1946* (HUFU, SPF); Ave. Indianópolis, *W. Hoehne 1948* (BHCB, G, HUFU, MBM, RB, SP, SPF); Bairro do Limoeiro, *P. Gonçalves 4073* (SP); Ipiranga, *H. Luederwaldt 2007* (SP, RB); São Manuel, *R. Montanholi 140* (SP); Serra da Bocaina, *A. C. Brade 20683* (RB), *O. Handro 1168* (HUFU, SPF).

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Haydenoxylon, a Replacement Name for *Haydenia* (Celastraceae)

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Abstract. *Haydenia* M. P. Simmons (Celastraceae) is an illegitimate name because it is a later homonym of *Haydenia* Seward (Cyatheaceae). The genus is renamed *Haydenoxylon* M. P. Simmons and the three included species are renamed *Haydenoxylon gentryi* (Lundell) M. P. Simmons, *H. haberianum* (Hammel) M. P. Simmons, and *H. urbanianum* (Loes.) M. P. Simmons. The name *H. urbanianum* is lectotypified.

Key words: Celastraceae, *Gymnosporia*, *Haydenia*, *Haydenoxylon*.

M. P. Simmons in McKenna et al. (2011) transferred the three New World species of *Gymnosporia* (Wight & Arn.) Benth. & Hook. f. (Celastraceae) to the new genus *Haydenia* M. P. Simmons, named in honor of W. John Hayden (1951–). *Haydenia* Seward, a name with a fossil type, is not listed in The International Plant Names Index (IPNI; <http://www.ipni.org>), which includes information from Index Kewensis, the Gray Card Index, and the Australian Plant Names Index. Not finding the name in IPNI, Simmons made the incorrect inference that the name had not been previously used for any taxon covered by the *International Code of Nomenclature for Algae, Fungi, and Plants* (McNeill et al., 2012). But, as reported by both Index Nominum Genericorum (<http://botany.si.edu/ing>) and Tropicos® (<http://www.tropicos.org>), Seward (1912) described Mesozoic fossil fern pinnae from northern Afghanistan. Seward (1912) named these fossils *H. thyrsopteroides* (putatively assigned to the Cyatheaceae), with the genus being named after the then director of the Indian Geological Survey. The later homonym *Haydenia* M. P. Simmons is, therefore, illegitimate according to Article 53.1 of the International Code (McNeill et al., 2012).

We correct the error here by proposing the replacement name *Haydenoxylon* and transferring the three species assigned to *Haydenia*. By doing so the gender changes from feminine to neuter, so two of the species epithets are modified accordingly. The new genus name maintains the honorific to W. John Hayden and the *–xylon* ending is appropriate for both a genus consisting of trees and for W. John Hayden's many contributions to the study of wood anatomy (e.g., Hayden & Brandt, 1984; Hayden et al., 1993; Hayden & Hayden, 2000).

I. Haydenoxylon M. P. Simmons, nom. nov. Replaced name: *Haydenia* M. P. Simmons, Syst. Bot. 36: 929. 2011, nom. illeg., non *Haydenia* Seward, Mem. Geol. Surv. India, Palaeontol. Indica 4(4): 13. 1912. TYPE: *Haydenoxylon urbanianum* (Loes.) M. P. Simmons.

1. Haydenoxylon gentryi (Lundell) M. P. Simmons, comb. nov. Basionym: *Gymnosporia gentryi* Lundell, Phytologia 57: 313. 1985. *Haydenia gentryi* (Lundell) M. P. Simmons, Syst. Bot. 36: 929. 2011, nom. illeg. TYPE: Colombia. Nariño: La Planada, Salazar Finca 7 km above Ricaurte, premontane wet forest ca. 1°08′N, 77°58′W, 1750 m, 28 Nov. 1981 (fl., fr.), *A. Gentry, C. Barbosa, E. Barrera, C. Bonifaz, H. Cuadros, L. Quiñones, E. Renteria & D. Sanchez 35068* (holotype, LL; isotypes, MO-3002259, MO-3002260).

2. Haydenoxylon haberianum (Hammel) M. P. Simmons, comb. nov. Basionym: *Gymnosporia haberiana* Hammel, Novon 7: 147. 1997. *Haydenia haberiana* (Hammel) M. P. Simmons, Syst. Bot. 36: 929. 2011, nom. illeg. TYPE: Costa Rica. Guanacaste: Cordillera de Tilarán, La Cruz de Abangares, 1400 m, 15 July 1985 (fl.), *W. A. Haber & E. Bello C. 2034* (holotype, INB; isotypes, BM, C, CAS, COL, CR, DUKE, F, FLAS, GH, HNMN, K, MEXU, MICH, MO, NY, P, PMA, TEX, US, USJ, W, WIS).

3. Haydenoxylon urbanianum (Loes.) M. P. Simmons, comb. nov. Basionym: *Rhacoma urban-*

iana Loes., Repert. Spec. Nov. Regni Veg. 1: 162. 1905. *Gymnosporia urbaniana* (Loes.) Liesner, Monogr. Syst. Bot. Missouri Bot. Gard. 45: 1254. 1993. *Haydenia urbaniana* (Loes.) M. P. Simmons, Syst. Bot. 36: 929. 2011, nom. illeg. TYPE: Peru. Junin: Tarma, La Merced en el valle Chanchamayo, 1000 m, Dec. (fl.), *A. Weberbauer 1875* ([holotype, B†, B photo at F neg. 133332, B photo at MO]; lectotype, designated here, MOL).

The MOL sheet was chosen as the lectotype because it is the only extant sheet of *A. Weberbauer 1875* that we are aware of, and it is available for viewing online through JSTOR Global Plants (<http://plants.jstor.org>).

Acknowledgments. We thank Victoria Hollowell for editorial corrections and Gerrit Davidse and Teri Bilsborrow for first calling our attention to this error.

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A New Species of *Minaria* (Apocynaceae, Asclepiadoideae) from Bolivia

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Abstract. *Minaria praetermissa* W. D. Stevens & Arbeláez (Apocynaceae, Asclepiadoideae) from the province of Santa Cruz in eastern Bolivia is found to be distinct from the related *M. acerosa* (Mart.) T. U. P. Konno & Rapini. A description, diagnosis, and comparative illustrations are provided.

Key words: Apocynaceae, Asclepiadoideae, Bolivia, IUCN Red List, *Minaria*.

Minaria T. U. P. Konno & Rapini was first recognized as a clade through molecular studies (Rapini et al., 2006) and separately described as a genus (Konno et al., 2006). As described within the Asclepiadoideae (Apocynaceae), the genus comprised 19 species, 18 transferred from *Ditassa* R. Br. and one described as new. A practical key to the species was provided as well as line drawings of five species and photographs of two additional species. A composite map shows that the species are concentrated in the state of Minas Gerais and just reaching the eastern edges of Argentina and Bolivia. The ranges of the individual species are not defined, but it is implicit that *M. acerosa* (Mart.) T. U. P. Konno & Rapini is the only species not endemic to Brazil. Further, in the herbarium holdings and database holdings of the Missouri Botanical Garden (MO), mostly annotated by the authors of the genus, *M. acerosa* is the only species of the genus in Argentina and Bolivia. Two additional species have since been added (Silva et al., 2012), again on molecular grounds, both endemic to Bahia, Brazil.

Although the Bolivian specimens at MO identified as *Minaria acerosa* will easily run through the key (Konno et al., 2006) to that name, and are at first glance similar to that species, there are obvious differences from the Brazilian specimens at MO identified with the same name. Careful comparison of specimens from the eastern (Minas Gerais) and western (Bolivia) portions of the distributional range convinces us that they are not the same species, and the latter requires a name.

Minaria praetermissa W. D. Stevens & Arbeláez, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Chiquitos, Serranía de Santiago de Chiquitos, sobre el sendero ecológico en la zona del Mirador, 18°19′31″S, 059°33′55″W, 900 m, 22 Oct. 2006, *D. Villarroel, Y. Bustamante & T. Palacios 887* (holotype, USZ; isotype, MO). Figures 1D–F, 2A–E.

Diagnosis. This new species is most similar to and until now confused with *Minaria acerosa* (Mart.) T. U. P. Konno & Rapini, from which it differs most notably by the calyx lobes narrowly lanceolate, 1.6–2.2 mm long and equaling the corolla (vs. ovate, ca. 1 mm long and about half as long as corolla), corolla lobes reflexed, flat, and sparsely farinose within (vs. erect, cucullate, and densely farinose), outer corona lobes exceeding and arching over the gynostegium (vs. erect and shorter than the gynostegium), and by the inner corona lobes lanceolate, the same shape as the outer (vs. ovate and distinctly wider than the outer).

Clumped herb or subshrub, rhizome woody and developing thin cork, trailing and possibly twining at tips, latex present; stem densely white tomentulose, hairs generally ascending, ca. 0.2 mm long. Leaves opposite and decussate on short internodes, margins revolute to the extent that only the midrib is exposed below, in natural form linear, 3.5–6 × 0.5–1.5 mm, obtuse to rounded at both ends, coriaceous, deeply wrinkled when dry, hispidulose, apparently without colleters, secondary venation not visible; petioles 0.5–1 mm, hispidulose. Inflorescences racemiform, hispidulose, 1- to 4-flowered, peduncle 0.5–1.2 mm, bracts 0.8–1.5 × 0.2 mm, pedicels 1–1.5 mm; calyx lobes narrowly lanceolate, 1.6–2.2 × 0.3–0.5 mm, strictly erect, hispidulose outside, with 1 colleter in each sinus; corolla white, yellow, or greenish yellow, nearly rotate, hispidulose outside, tube ca. 0.5 mm long, lobes reflexed, deltate, flat, 1.2–1.5 × 0.6 mm, white farinose inside; gynostegium 0.8–1 × 0.5–0.6 mm, sessile; corona lobes opposite the anthers, borne near base of gynostegium, double, free to base, outer lobe narrowly lanceolate, 0.7–1.1 × 0.1–0.2 mm, arching over gynostegium, inner lobe of similar shape except 0.5–0.6 mm long; style apex convex; pollinia pendent. Follicles fusiform, ca. 13 × 2 mm, smooth, hispidulose; seeds few, mature seeds unknown.

In addition to the diagnostic characters given above, this new species seems to be much less robust than *Minaria acerosa* and has smaller and fewer-flowered inflorescences (in *M. praetermissa*, one to

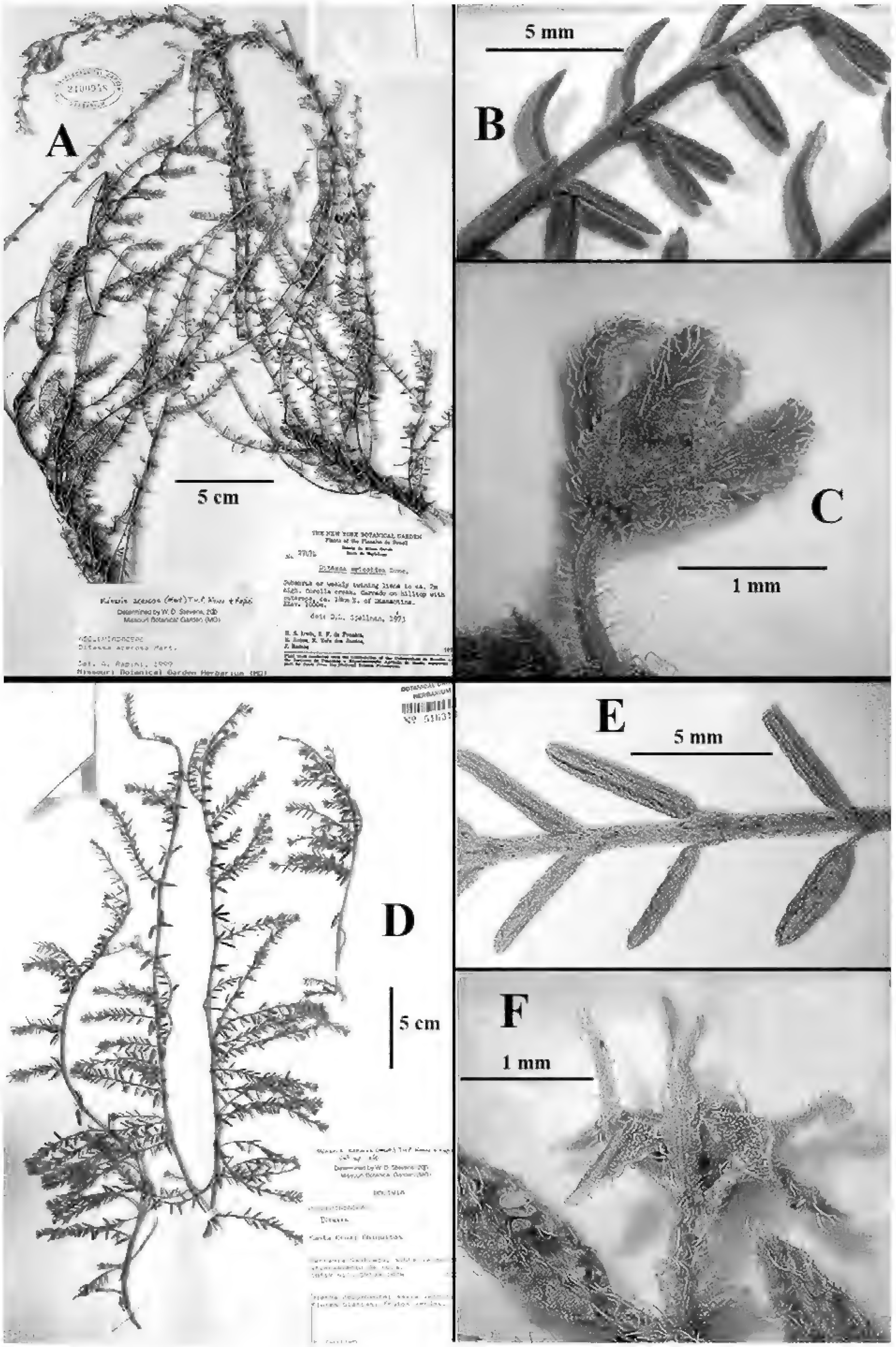


Figure 1. A–C. *Minaria acerosa* (Mart.) T. U. P. Konno & Rapini. —A. Habit. —B. Leaves. —C. Flower. D–F. *Minaria praetermissa* W. D. Stevens & Arbeláez. —D. Habit. —E. Leaves. —F. Flower. A–C taken from *H. S. Irwin, S. F. da Fonsêca, R. Souza, R. Reis dos Santos & J. Ramos 27474* (MO); D–F from *R. Guillén V., L. Sánchez A., S. Ortiz & L. Surubí 4822* (MO).

four flowers, and in *M. acerosa*, one to 16). *Minaria acerosa* has more rigid and patent stem hairs. The leaves of *M. praetermissa* are always opposite, while in *M. acerosa* most nodes are actually two superimposed nodes, resulting in apparently whorled leaves. *Minaria acerosa* has the adaxial surface of the corolla lobes densely white farinose, completely covering the surface, and in the center of the base with a small

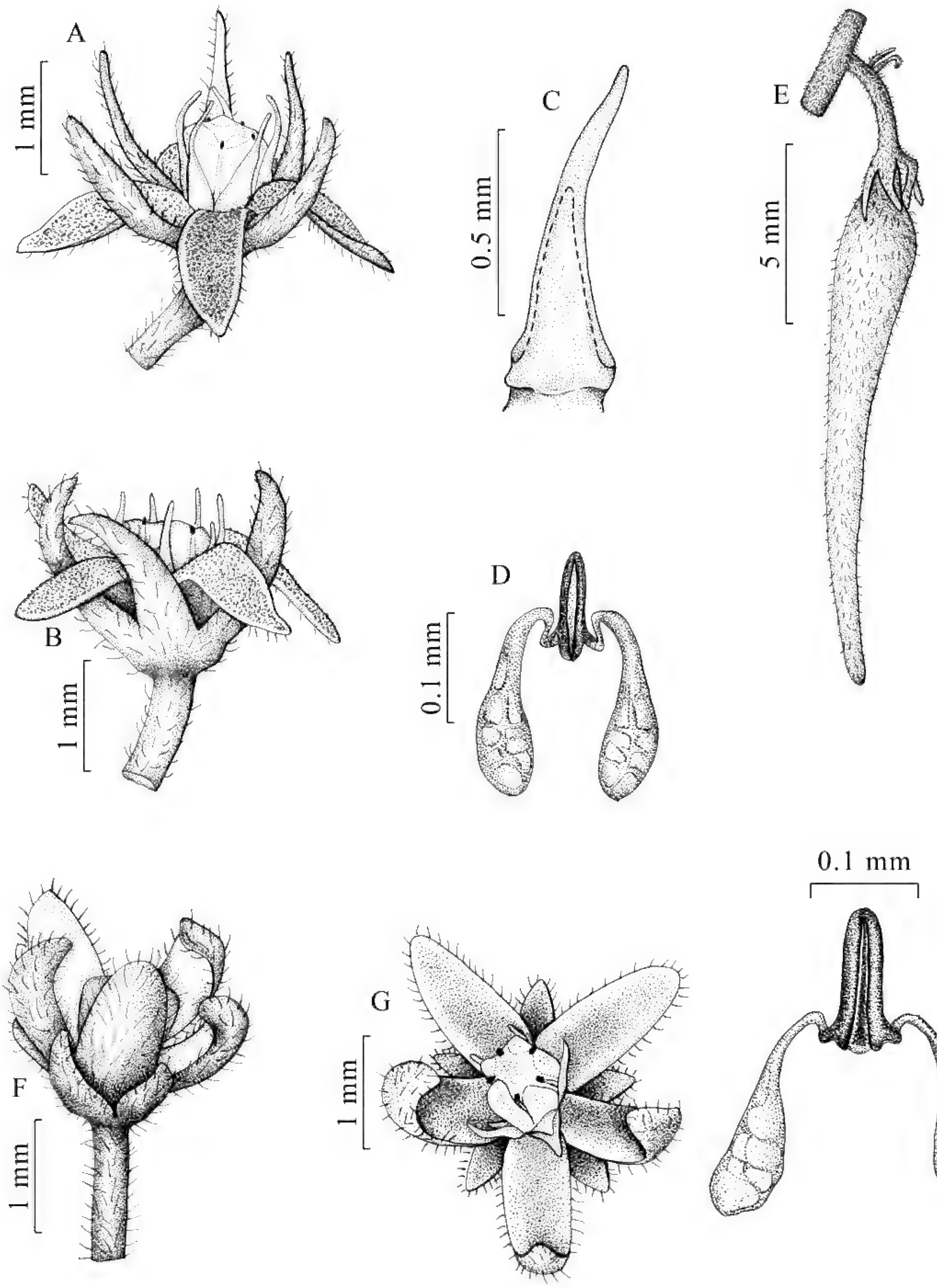


Figure 2. A–E. *Minaria praetermissa* W. D. Stevens & Arbeláez. A, B. Flowers. —C. Corona lobes, internal corona represented by dashed lines. —D. Pollinia. —E. Fruit. F, H. *Minaria acerosa* (Mart.) T. U. P. Konno & Rapini. F, G. Flowers. —H. Pollina. A, B drawn from *R. Guillén V., L. Sánchez A., S. Ortiz & L. Surubí 4822* (MO); C–E from *A. Fuentes, E. Guzmán & C. Cabrera 1774* (MO); F, G from *H. S. Irwin 27058* (MO); H from *M. A. Farinaccio 283* (MO).

patch of erect, longer, glassy hairs, while in *M. praetermissa* the farinose hairs are less dense, not quite covering the surface, and the glassy hairs are absent or inconspicuous.

Distribution and ecology. All four known collections of *Minaria praetermissa* are from southeastern Bolivia, near the border with Brazil. The map showing the distribution of all collections of the genus *Minaria*

(Konno et al., 2006) has a core concentration of species and collections in Minas Gerais, with three extensions, one to the southwest and reaching easternmost Argentina, one northeastward, and the third directly to the west and reaching several known localities/dots in southeastern Bolivia, which is precisely where the four localities of *M. praetermissa* are found. These mapped dots presumably represent *M. acerosa* in the sense of that treatment (Konno et al., 2006) and also presumably represent additional collections of *M. praetermissa*. As here described, *M. praetermissa* is a political endemic of Santa Cruz, Bolivia, and probably the only species of *Minaria* in Bolivia. However, there are several localities of presumed *M. acerosa* sensu Konno in Mato Grosso and Mato Grosso do Sul, Brazil, areas/states adjacent to Santa Cruz. These lie relatively distant from the core distribution in Brazil, and it would not be surprising to find that some or all of those represent this new species.

IUCN Red List category. Since this new species is described from the Bolivian collections of a distribution that could well extend into the Brazilian states of Mato Grosso and Mato Grosso do Sul, and since it would be impractical to match the dots on the Konno map (2006) with specific herbarium collections, presumably in Brazilian herbaria, the area of occupancy of the species cannot be reasonably estimated and the Red List category (IUCN, 2001) cannot be reasonably assigned.

Paratypes. BOLIVIA. **Santa Cruz:** Prov. Angel Sandoval, Valle de Sunsas-Serranía Bella Boca, 30 km O de Santo Corazón, 17°57′53″S, 59°1′33″W, 750 m, 25 abr. 1997, *A. Fuentes, E. Guzmán & C. Cabrera 1774* (MO, USZ); Prov. Chiquitos, Serranía de Santiago, sobre la meseta, 18°19′41″S, 59°34′18″W, 650 m, 26 Nov. 1999, *R. Guillén V., L. Sánchez A., S. Ortiz & L. Surubí 4822* (MO, USZ); Prov. Chiquitos, Serranía de Santiago, Santiago de Chiquito, 18°40′S, 59°15′W, 800 m, 13 Nov. 1997, *F. Mamani & A. Jardim 1251* (MO, USZ).

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Two New Species of *Piper* (Piperaceae) from Thailand

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Abstract. Two new species, *Piper durionoides* Suwanph. & Chantar. and *P. kongkandanum* Suwanph. & Chantar. (Piperaceae), are described from southwestern Thailand. *Piper durionoides* is characterized by a persistent stylelike spine or echinate and glabrous infructescence. The distinguishing characters of *P. kongkandanum* combine vegetative and reproductive organs. This species has pilose or velutinous branchlets with uniseriate hairs. The floral bracts are hairy at the base and ciliate at the margin, and fruits are connate for 3/4 length on rachis. The description and illustration are presented. The IUCN conservation status of both species is assessed as VU, or Vulnerable.

Key words: IUCN Red List, *Piper*, *Piper* sect. *Chavica*, Piperaceae, Thailand.

Piper L. is the largest genus in the family Piperaceae, which contains about 1050 species distributed mainly in the tropics (Mabberley, 2008). Distinctive characters of *Piper* include swollen stem nodes and minute, unisexual flowers compacted together on a fleshy rachis. The flowers lack a perianth, consisting only of the male and female reproductive parts, which are subtended by one to three floral bracts. The number of stamens varies from three to 12, varying in infraspecific and interspecific taxa from three to five, five to eight, or eight to 12 stamens. The anther is distinguished by two or four theca, with longitudinal or transverse dehiscence. The fruit in *Piper* is a drupe, with the exception of a nutlet in *P. umbellatum* L. (Suwanphakdee, 2012).

Asian taxa of the Piperaceae have been studied on the Indian subcontinent by Wallich (1824–1849), Hooker (1887), Long (1984), and Huber (1987); from China by Yongqian and Gilbert (1999); from Indo-China and the Philippines by C. de Candolle (1910, 1912, 1923) and Gardner (2006); on the Malay Peninsula by Ridley (1924); and in Indonesia by Blume (1826) and Backer and Bakhuizen van den Brink (1963). The only published treatment for the Piperaceae in Thailand (Suwanphakdee, 2005) listed 35 taxa (34 species and two varieties), subsequently followed by publications for new species and new country records (Suwanphakdee et al., 2006, 2012; Suwanphakdee & Chantaranothai, 2008, 2011; Suwanphakdee, 2012).

While preparing the taxonomic treatment of the Piperaceae for the Flora of Thailand, we examined specimens from the following herbaria: AAU, BK, BKF, BM, BO, C, G, G-DC, K, KEP, KKU, L, PSU, QBG, and SING. Unknown plants collected from Kanchanaburi and Phetchaburi provinces in Thailand represent two new species that are herein described and illustrated, with distinguishing characters from related taxa given.

1. Piper durionoides Suwanph. & Chantar., sp. nov. TYPE: Thailand. Kanchanaburi: Thong Pha Phum Natl. Park, 10 Nov. 2003 (♀ fl., fr.), *C. Suwanphakdee 69* (holotype, BKF; isotypes, BK, KKU, MO, QBG). Figure 1.

Species *Piperi nigranthero* C. DC. affinis, sed ab eo ramulis puberulis pilosis vel velutinis, laminis foliaribus utrinque puberulis vel pilosis, infructescentiis et fructibus glabris praeter bractearum persistentium basin pilosam atque fructibus in stylum persistentem spiniformem ultra 2 mm longum desinentibus infructescentiae faciem echinatam conferentibus differt.

Woody climber; dioecious; branchlets puberulous, pilose, or velutinous; nodes swollen, with climbing adventitious roots. Leaves with petioles 1–2 cm, pilose; stipules hoodlike, lanceolate, ca. 1 cm, pilose or velutinous, caducous; leaf lamina chartaceous, elliptic to oblong or ovate, asymmetric, 10–20 × 5–8 cm; base oblique, cordate, auriculate, truncate, or rounded; apex acuminate, aristate or sometimes acute; margin undulate; adaxial surface dark green; abaxial surface pale green or yellow, puberulous or pilose on both surfaces; venation pinnate, with 2 or 3 nerves from base, pilose. Inflorescence a catkin,

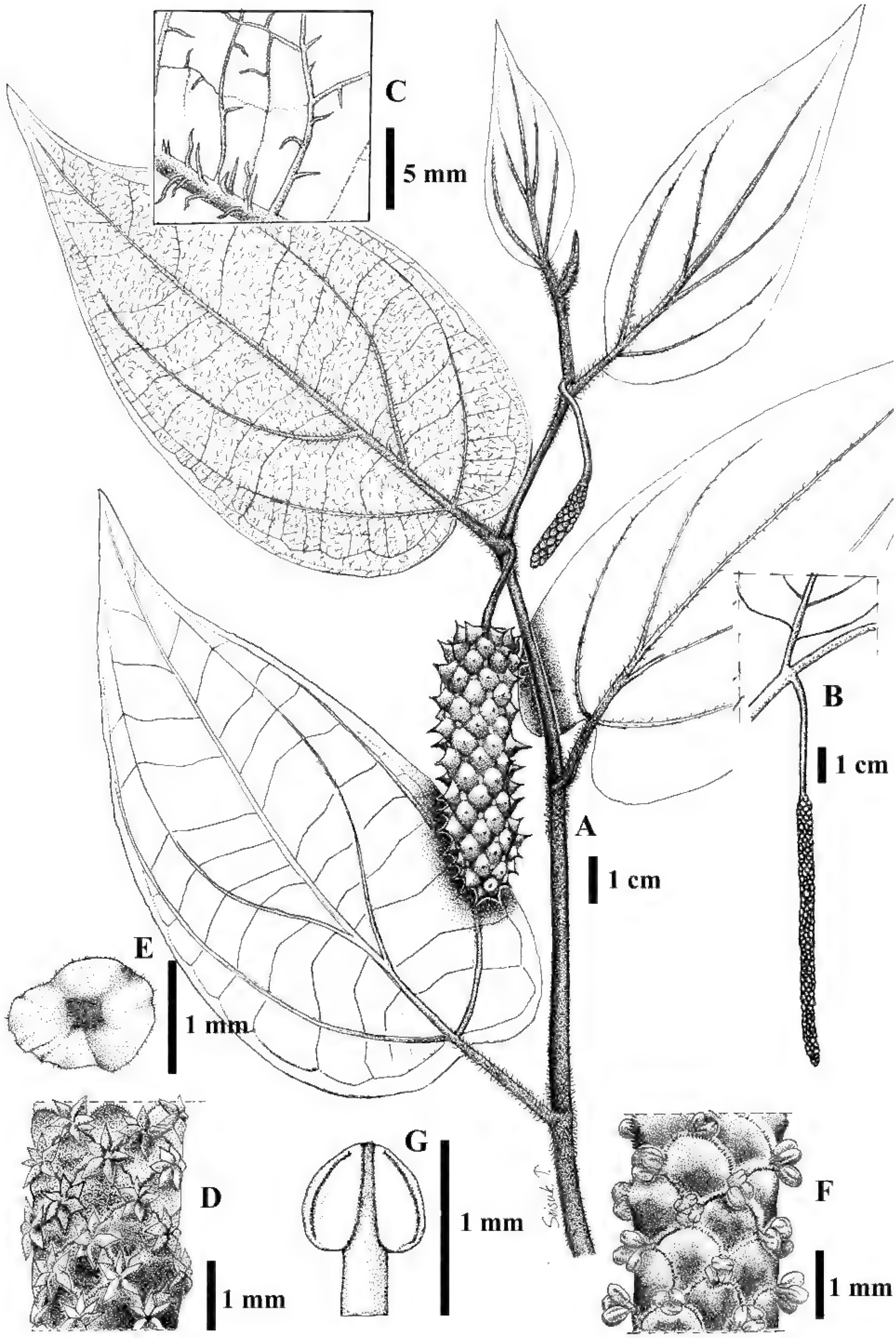


Figure 1. *Piper durionoides* Suwanph. & Chantar. —A. Branch with female inflorescence and infructescence. —B. Male inflorescence. —C. Detail of hairs on the lamina. —D. Close-up of portion of the female inflorescence showing star-shaped stigmas. —E. Floral bract with ciliate margin. —F. Close-up of portion of the male inflorescence. —G. Detail of stamen. Drawn from the holotype *C. Suwanphakdee 69* (BKF) and male inflorescence from the paratype *C. Suwanphakdee 38* (BKF).

terminal or in the upper leaf axils, opposite to the petiole, pendulous, cylindrical, green; the fertile rachis hairy, with densely compacted flowers; floral bracts rounded or peltate, ca. 1 mm diam., ciliate throughout the margin, with the base short, and hairy at the base. Male inflorescence 5–7 × 0.1–0.2 cm, white or pale green; peduncles 2–4 cm, glabrous or puberulous. Male flowers with 3 to 5 stamens; filaments ca. 1 mm; anthers 2-valved and slightly exserted to exserted at anthesis, 0.6–0.7 mm, with lateral dehiscence. Female inflorescence 3–5 × 0.4–0.5 cm, white; peduncles 1.5–2 cm, pilose. Female flowers with ovary ± globose; stigma star-shaped, 3- to 5-lobed, hairy, style exceeding 2 mm, persistent and stiff-pointed. Infructescence 4–7 × 1–1.5 cm, glabrous pendulous, cylindrical, with an echinate appearance from the persistent styles, peduncles 2–3 cm, pilose; fruits connate on rachis and glabrous, with persistent floral bracts and spinelike styles.

Distribution and ecology. *Piper durionoides* is endemic to Thailand and occurs at 500–800 m in southwestern Thailand (Kanchanaburi and Phetchaburi provinces) in evergreen forests nearby streams or waterfalls.

ICUN Red List category. *Piper durionoides* is uncommon and found in Kanchanaburi and Phetchaburi provinces in southwestern Thailand. We assess the new species with the provisional rating of Vulnerable, or VU, according to IUCN (2001) criteria.

Phenology. The flowering period is from November through April, and *Piper durioides* has been collected in fruit from December to April.

Etymology. The specific epithet refers to characters of coalescent fruits, each surmounted by a persistent spinelike style, which resembles the durian fruits of *Durio zibethinus* Rumph. ex Murray (Bombacaceae).

Discussion. *Piper durionoides* is distinguishable from *P. nigrantherum* C. DC. by its puberulous, pilose, or velutinous branchlets (vs. glabrous to puberulous in *P. nigrantherum*), both surfaces of the leaves puberulous or pilose (vs. glabrous or puberulous only on the lower surface), and glabrous fruit and infructescence, except for the base of the persistent bract (vs. bracts completely hairy). The new species also differs in having a persistent style on the fruit, with the infructescence echinate in overall appearance (vs. muricate), with the fruits topped by spinelike, stylar apices more than 2 mm long (vs. fruits with apices obtuse to acute, less than 2 mm long). The persistent, stylar spines on the fruit and the glabrous, echinate appearance of the infructescence are diagnostic characters for the new species. We place *P. durionoides* in *Piper* sect. *Chavica* (Miq.) Hook. f. on the basis of its solitary inflorescence, bract orbicular peltate, fruit very small, crowded sessile in dense cylindric or oblong infructescence, based on Hooker (1887) and Ridley (1924).

Paratypes. THAILAND. **Kanchanaburi:** Khao Chalat, 7 Aug. 1923 (fr.), *D. J. Collins 927* (BK); Thong Pha Phum Natl. Park, 15 Apr. 2004 (fr.), *C. Suwanphakdee 128* (BK, BKF, KKU, MO, QBG); 11 Aug. 1968 (♀ fl.), *B. Nimanong & S. Phusomsaeng 269* (BKF). **Phetchaburi:** Kaeng Krachan Natl. Park, 15 May 2003 (♂ fl.), *C. Suwanphakdee 38* (BK, BKF, KKU); 7 Apr. 2004 (♀ fl.), *C. Suwanphakdee 122* (BKF, KKU).

2. Piper kongkandanum Suwanph. & Chantar., sp. nov. TYPE: Thailand. Kanchanaburi: Sangklaburi, 5 July 2008 (fr.), *C. Suwanphakdee 239* (holotype, BKF; isotypes, BK, KKU, MO, QBG). Figure 2.

Species *Piperi ramipilo* C. DC. affinis, sed ab eo ramulis pilosis vel velutinis trichomatibus uniseriatis, foliis chartaceis asymmetrice ellipticis usque oblongis quam inflorescentiis consociatis majoribus, inflorescentiis brevioribus atque bracteis ad basin pilosis marginibus ciliatis differt.

Woody climber; dioecious; branchlets puberulous, pilose, or velutinous, with uniseriate hairs; nodes swollen, with climbing roots. Leaves with petioles 0.8–2 cm, puberulous, pilose, rarely velutinous; stipules hoodlike, lanceolate, 0.5–1 cm, puberulous or pilose, caducous; lamina chartaceous or subcoriaceous, elliptic to oblong, asymmetric, 12–25 × 4–9 cm; base oblique or auriculate, sometimes cordate; apex acuminate, aristate, or acute; margin undulate; abaxial surface dark green; adaxial surface pale green or yellow, puberulous or pilose; venation pinnate, 2- or 3-nerved, puberulous or pilose. Inflorescence a catkin, terminal or in the upper axils of leaves, smaller, generally less than half the lengths of blades, opposite to the petiole, pendulous, cylindrical, green, with dense flowers, rachis hairy; floral bract rounded or peltate, ca. 1 mm diam., with short stalk ca. 1 mm, floral bract margin ciliate and basal with hairs. Male inflorescence 3–7 × 0.1–0.2 cm; peduncles 1–3 cm long, pilose. Male flowers with 3 to 5 stamens; filaments ca. 1 mm; anthers 0.5–0.6 mm, with 2 valves, lateral dehiscence, slightly exserted at anthesis. Female inflorescence 2–3 × 0.1–0.2 cm, white; peduncles 3–4 cm, pilose. Female flowers with the ovary ± globose; stigma star-shaped, 4- or 5-

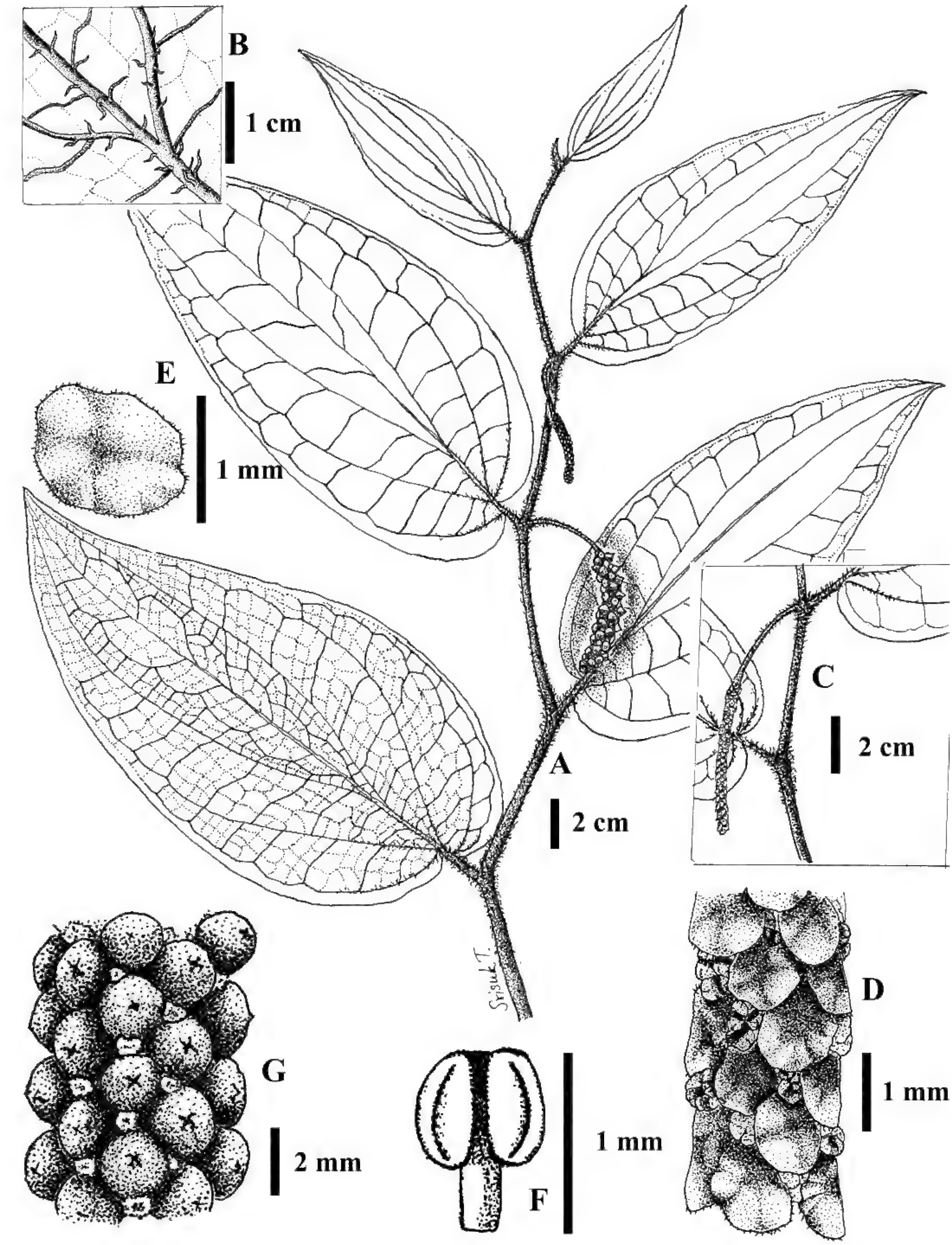


Figure 2. *Piper kongkandanum* Suwanph. & Chantar. —A. Branch with female inflorescence and infructescence. —B. Detail of hairs on lamina. —C. Male inflorescence. —D. Close-up of portion of the female inflorescence. —E. Floral bract with ciliate margin. —F. Detail of stamen. —G. Close-up of portion of the infructescence. Drawn from the holotype *C. Suwanphakdee 239* (BKF) and male inflorescence from the paratype *C. Suwanphakdee 128* (BKF).

lobed, hairy; style very short. Infructescence 5–8 × 0.8–1 cm, pendulous, cylindrical; peduncles 3–4 cm long, pilose; fruits ± globose, 2–3 mm diam., sessile, connate to 3/4 length on rachis, the fruit apex acute, with persistent floral bracts and stigma.

Distribution and ecology. *Piper kongkandanum* is endemic to Thailand, occurring at 400–600 m in southwestern Thailand (Kanchanaburi and Phetchaburi provinces). It grows near streams in shaded areas.

ICUN Red List category. This species is uncommon, and only a few specimens have been collected from Kanchanaburi and Phetchaburi provinces in southwestern Thailand. The status of *Piper kongkandanum* is assessed as Vulnerable, or VU, according to IUCN (2001) criteria.

Phenology. The flowering period of *Piper kongkandanum* extends from January through April, and the fruiting period is from May to August.

Etymology. The species is named in honor of Dr. Kongkanda Chayamait (1952–), outstanding Thai botanist of Bangkok Forest Herbarium (BKF), who directed the first author's interest on the family Piperaceae for the Flora of Thailand Project.

Discussion. *Piper kongkandanum* differs from *P. ramipilum* C. DC. by having pilose or velutinous branchlets with uniseriate hairs (vs. velutinous and glabrescent with ramulose hairs in *P. ramipilum*), chartaceous leaves that are larger than the associated inflorescences, 12–25 × 4–9 cm (vs. leaves coriaceous, 9–13 × 3–6 cm), floral bracts that are hairy at the base and have ciliate margins (vs. glabrous floral bracts with non-ciliate margins), and shorter inflorescences, with the male inflorescences 3–7 cm (vs. 9–12 cm) and the female inflorescences 2–3 cm (vs. 6–8 cm), and shorter infructescences 5–8 cm (vs. 6–14 cm). *Piper kongkandanum* is new to science based on the floral bracts with ciliate margins and the fruit connate to 3/4 their length. The branchlets are puberulous, pilose, or velutinous with uniseriate hairs that are puberulous or pilose on both leaf surfaces. Based on the distinctive characters of solitary inflorescence, bract orbicular peltate, fruit very small, crowded sessile in dense cylindric or oblong infructescence, we place this species under *Piper* sect. *Chavica*, according to Hooker (1887) and Ridley (1924)'s classification.

Paratypes. THAILAND. **Kanchanaburi:** Sangkhlaburi, 25 Jan. 1925 (♀ fl.), *A. F. G. Kerr 10336* (BK); Kwae Noi River Basin, 28 May 1946 (♀ fl.), *A. Kostermans 745* (BK, SING); Sisawat, 14 Aug. 1968 (fr.), *P. Sangkhachand 1510* (BK); Thong Pha Phum Natl. Park, 15 Apr. 2004 (♂ fl.), *C. Suwanphakdee 128* (BK, BKF, KKU, MO, QBG); Khao Laem Natl. Park, 1 May 2009 (fr.), *C. Suwanphakdee 273* (BK, BKF). **Phetchaburi:** Kaeng Krachan Natl. Park, 3 Apr. 2004 (♀ fl.), *C. Suwanphakdee 119* (BK, BKF, KKU, MO, QBG).

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Three New Species of *Eleocharis* subg. *Scirpidium* (Cyperaceae) and a Key to Identify the Subgenus in Brazil

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Abstract. Three new species of *Eleocharis* R. Br. subg. *Scirpidium* (Nees) Kukkonen (Cyperaceae) from southern Brazil are described and illustrated: *E. angustirostris* R. Trevis. & Boldrini, *E. neesii* R. Trevis. & Boldrini, and *E. riograndensis* R. Trevis. & Boldrini. They have fertile proximal scales and achenes with longitudinal rows of horizontally oriented rectangular cells, characteristic of *Eleocharis* subg. *Scirpidium*. *Eleocharis angustirostris* is distinguished from all the Brazilian species of the subgenus by the achene narrowing into a neck and the narrow stylopodium that appears to be a continuation of the neck; *E. neesii* is related to *E. radicans* (Poir.) Kunth from which it differs in having capillary culms and an inflated apex of the distal sheath. *Eleocharis riograndensis* is distinguished from all the Brazilian species of *Eleocharis* subg. *Scirpidium* by a combination of features including capillary culms, the long acuminate distal sheath apex, and two stamens with short anthers. A key is presented to separate the species of *Eleocharis* subg. *Scirpidium* known to occur in Brazil.

Resumo. Três novas espécies de *Eleocharis* R. Br. subg. *Scirpidium* (Nees) Kukkonen (Cyperaceae) no sul do Brasil são descritas e ilustradas: *E. angustirostris* R. Trevis. & Boldrini, *E. neesii* R. Trevis. & Boldrini, e *E. riograndensis* R. Trevis. & Boldrini. As espécies apresentam a gluma inferior fértil e aquênios com fileiras longitudinais de células retangulares orientadas horizontalmente, características de *Eleocharis* subg. *Scirpidium*. *Eleocharis angustirostris* se distingue das demais espécies brasileiras do subgênero pelo aquênio se estreitando em um pescoço e o estilopódio estreito que parece ser uma continuação do mesmo; *E. neesii* é semelhante à *E. radicans* (Poir.) Kunth, do qual difere pelo colmo capilar e pelo ápice da bainha superior inflado. *Eleocharis riograndensis* difere das demais espécies brasileiras do *Eleocharis* subg. *Scirpidium* por uma combinação de caracteres que inclui colmos capilares, ápice da bainha superior longo acuminado, e dois estames com anteras curtas. É apresentada uma chave para separar as espécies de *Eleocharis* subg. *Scirpidium* que ocorrem no Brasil.

Key words: Brazil, Cyperaceae, *Eleocharis*, IUCN Red List, Rio Grande do Sul, subgenus *Scirpidium*.

Eleocharis R. Br. (Cyperaceae) is a widely distributed genus of more than 200 species (González-Elizondo & Peterson, 1997) with a concentration of taxa in tropical and subtropical America (Goetghebeur, 1998). The species are generally associated with wet environments. While studying specimens of *Eleocharis* from southern Brazil, we found three undescribed species that assign to *Eleocharis* subg. *Scirpidium* (Nees) Kukkonen [= *Eleocharis* ser. *Aciculares* (C. B. Clarke) Svenson]. This subgenus of annual or perennial herbs is characterized by

having spikelets often with the proximal-most scale fertile, a trifid style, and terete or very obtusely trigonous achenes, which have a fragile and translucid pericarp, 0.01–0.04 mm thick, that forms longitudinal rows of horizontally oriented rectangular cells (González-Elizondo & Peterson, 1997).

More than 90% of the ca. 15 species in *Eleocharis* subg. *Scirpidium* are found in the New World in areas of temperate to cold climates from Alaska and Greenland to southern Chile and Argentina (Svenson, 1929; González-Elizondo & Tena-Flores, 2000). A center of diversity of *Eleocharis* subg. *Scirpidium* lies within the United States and northern Mexico, with a secondary center in the Andes, where at least four endemic species occur. In tropical and subtropical areas, the group is restricted to high elevations (González-Elizondo & Tena-Flores, 2000).

Eleocharis subg. *Scirpidium* is a distinctive and well-delimited group within the genus *Eleocharis* (González-Elizondo & Peterson, 1997; Roalson et al., 2010). However, there are species complexes within this group where discontinuity among the taxa is not easily perceived. This difficulty was reported by Svenson (1939), based in part from the overlap of morphological characteristics among species. Examples include *E. acicularis* (L.) Roem. & Schult., found in the Northern Hemisphere and the Andes, and *E. bonariensis* Nees, from austral South America to Mexico, in which a wide range of variability occurs. This high morphological variability could indicate active speciation or environmental adaptation that are not detectable simply by morphological analysis. Thus, this subgenus is in urgent need of a global phylogenetic review.

In the following descriptions, the measurements of the achenes include the stylopodium.

1. Eleocharis angustirostris R. Trevis. & Boldrini, sp. nov. TYPE: Brazil. Rio Grande do Sul: Mun. Osório, BR 101, Km. 91, 15 Oct. 2003, *I. Boldrini & R. Trevisan 1187* (holotype, ICN). Figure 1A–F.

Haec species *Eleochariti bonariensi* Nees affinis, sed ab ea vagina foliari apicali tenui hyalinaque, squamis floralibus hyalinis stramineisve, achenio anguste elliptico ad apicem in collum angustato et stylopodio anguste conico a collo vix distincto differt.

Perennial herbs, caespitose and stoloniferous, usually with thin and non-lignified base, stolons ca. 1 mm wide; culms 8–22 cm × 0.3–0.6 mm, sulcate when dried, spongy, firm, not septate; sheaths stramineous to light brown at the base, tubular to somewhat inflated toward the oblique apex, emucronate, hyaline, edges delicate and inconspicuous. Spikelets 5–8 × 2 mm, lanceoloid, 10- to 25-flowered, not proliferous; proximal scale fertile, membranous, lanceolate to oblong, apex obtuse to acute, stramineous, ca. the length of adjacent scales, with a wide hyaline margin; floral scales 2–2.9 × 0.5–0.6 mm, membranous, lanceolate to oblong, apex acute to obtuse, spirally arranged, appressed but loosely imbricate, finely striate, keel green to stramineous, sides hyaline, sometimes with some small vinaceous to brown spots, margin hyaline; perianth bristles none; stamens 3, anthers 1.2–1.8 mm, ending in a short apiculum; style trifid. Achene 1.3–1.6 × 0.4–0.5 mm, subterete to slightly trigonous, narrowly ellipsoid, with ca. 11 to 14 longitudinal rows of 50 to 60, horizontally oriented rectangular cells, constricted at the summit into a distinct neck, stramineous, iridescent; stylopodium narrowly conical, green to dark brown, scarcely differentiated from the achene neck and appearing as a continuation of it, ca. 1/4 as wide as the achene.

Distribution and habitat. *Eleocharis angustirostris* is known only from the type locality, found in sandy soils of wet grasslands with grazing. It is possible that this species may also occur in other areas of grasslands in the northern coastland of Rio Grande do Sul.

IUCN Red List category. Although *Eleocharis angustirostris* has been registered only for one region of the state of Rio Grande do Sul, it is relatively common in the area and may have a wider geographic distribution. We believe that it is not a threatened species. On the other hand, the region in which it was recorded is an area of intense agricultural activity that can lead to significant loss of habitat. Our data do not allow us to assess it as an endangered species. We suggest that *E. angustirostris* is a Near Threatened (NT) species, according to IUCN (2001) criteria.

Discussion. *Eleocharis angustirostris* is related to *E. bonariensis* and generally similar to it, but the new species can be distinguished by the achene narrowing at its summit into a neck, the narrow, conical stylopodium that is scarcely differentiated from the achene apex, and the pale to stramineous floral scales (vs. a widely conical stylopodium, which is separated from the achene body by a constriction, and floral scales stramineous to light brown, generally with vinaceous spots). The new species also differs in having the apex of the distal sheath more delicate than that in *E. bonariensis*

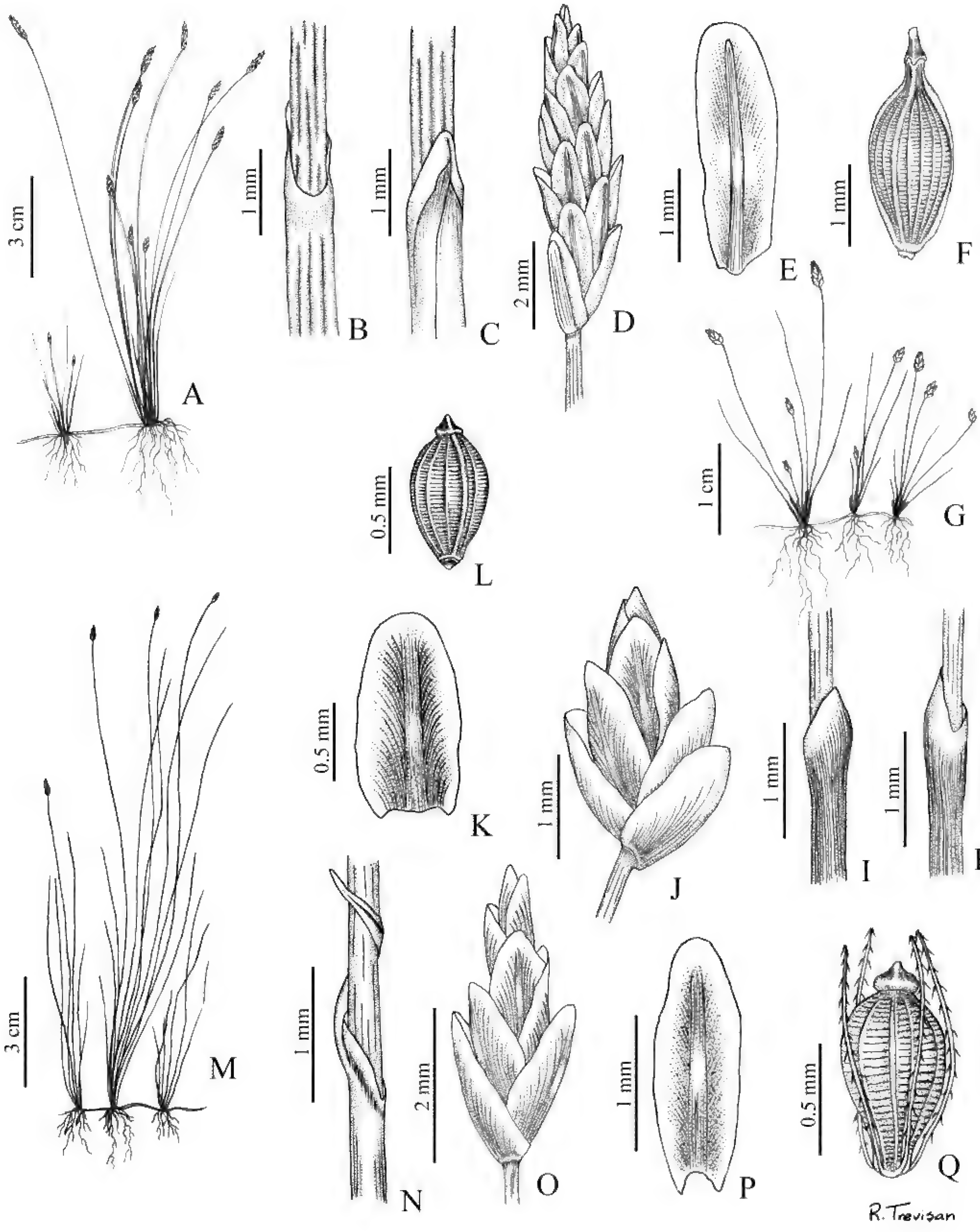


Figure 1. A–F. *Eleocharis angustirostris* R. Trevis. & Boldrini. —A. Habit. —B. Sheath, ventral view. —C. Sheath, dorsal view. —D. Spikelet. —E. Floral scale, dorsal view. —F. Achene. G–L. *Eleocharis neesii* R. Trevis. & Boldrini. —G. Habit. —H. Sheath, ventral view. —I. Sheath, dorsal view. —J. Spikelet. —K. Scale, dorsal view. —L. Achene. M–Q. *Eleocharis riograndensis* R. Trevis. & Boldrini. —M. Habit. —N. Sheath, lateral view. —O. Spikelet. —P. Scale, dorsal view. —Q. Achene. All species were drawn from the holotypes, *I. Boldrini & R. Trevisan 1187* (ICN), *G. Pedralli s.n.* (HURG), and *B. Rambo 36640* (PACA), respectively.

(where the distal sheath apex can be firm or scarious but not hyaline and delicate).

Paratypes. BRAZIL. **Rio Grande do Sul:** Osório, BR 101, Km. 91, 15 Oct. 2003, *I. Boldrini & R. Trevisan 1184*, *1185*, *1186*, *1188* (ICN).

2. Eleocharis neesii R. Trevis. & Boldrini, sp. nov. TYPE: Brazil. Rio Grande do Sul: Mun. Rio Grande, Lagoa Verde, 28 Nov. 1984, *G. Pedralli s.n.* (holotype, HURG-834). Figure 1G–L.

Haec species *Eleochariti radicanti* (Poiret) Kunth affinis, sed ab ea culmis capillaribus et vaginis foliaribus apice dilatatis differt.

Presumed perennial herbs, caespitose and stoloniferous, usually with thin non-lignified base, stolons capillary; culms 3–4 cm × 0.2–0.3 mm, capillary, somewhat angled, sulcate when dry, firm, spongy, not septate; sheaths stramineous at the base, apex somewhat oblique, hyaline, inflated, emucronate, edges delicate and inconspicuous. Spikelets 2.8–3 × 1.7 mm, ovoid, 8- to 10-flowered, not proliferous; proximal scale fertile, membranous, oval, apex acute to obtuse, stramineous, ca. the length of adjacent scales, with wide hyaline margin; floral scales 1.4–1.5 × 0.5–0.7 mm, membranous, oval, apex acute to obtuse, subdistichous, appressed, finely striated, keel stramineous, sides translucent white, margin hyaline; perianth bristles rudimentary or lacking; stamens 3, anthers 0.4–0.5 mm, ending in a short apiculum; style trifid. Achene 0.9 × 0.4–0.5 mm, ellipsoid, with ca. 8 longitudinal rows of 35 to 40 horizontally oriented rectangular cells, apex rounded, stramineous, iridescent; stylopodium short pyramidal, green to dark brown, separated from the achene body by a constriction, about 1/4 as wide as the achene.

Distribution and habitat. *Eleocharis neesii* is known only from the type locality and a single collection in 1984. It is possible that this species may also occur in southern coastlands of Rio Grande do Sul and Uruguay. *Eleocharis neesii* has been noted to grow in sandy soil of wet habitats with or near pools with shallow vegetation.

IUCN Red List category. *Eleocharis neesii* is considered Data Deficient (DD), according to IUCN (2001) criteria. Appropriate data on abundance and distribution are not available, so we cannot safely determine conservation status of this species.

Etymology. The epithet commemorates Christian Gottfried Daniel Nees von Esenbeck (1776–1858), who described *Eleocharis* subg. *Scirpidium*.

Discussion. *Eleocharis neesii* is a small plant with capillary stolons. The species is similar to *E. radicans* (Poir.) Kunth in having spikelets with less than 12 flowers, anthers less than 0.5 mm long, and short pyramidal stylopodium. It can be distinguished by the capillary culms and inflated apex of the distal sheath (vs. culms soft and flattened, usually 0.4–1 mm wide and non-inflated apex of the distal sheath). Flowers of *E. radicans* can be 2- or 3-stamened, with the Brazilian representatives of the species 2-stamened as far as is known, whereas *E. neesii* is 3-stamened.

3. Eleocharis riograndensis R. Trevis. & Boldrini, sp. nov. TYPE: Brazil. Rio Grande do Sul: Mun. Cambará do Sul, 5 Feb. 1948, *B. Rambo 36640* (holotype, PACA; isotype, NY, SI). Figure 1M–Q.

Haec species *Eleochariti radicanti* (Poiret) Kunth affinis, sed ab ea culmis longioribus tenuibus et vaginis foliaribus apice longiacuminatis differt. *Eleochariti bonariensi* Nees similis, sed ab ea culmis angustioribus, spiculis 6- ad 8-floribus, staminibus 2 et antheris 0.4–0.5 mm longis differt.

Probably perennial herbs, caespitose and stoloniferous, usually with thin, non-lignified base, stolons capillary; culms 18–23 cm × 0.2–0.3 mm, capillary, somewhat angled, soft and spongy when fresh, sulcate when dry, not septate; sheaths stramineous at the base, apex long-acuminate, hyaline, emucronate, delicate at tip, easily torn. Spikelets 3–4 × 1.7 mm, ovoid to lanceoloid, 6- to 8-flowered, not proliferous; proximal scale fertile, membranous, oval, apex acute to obtuse, stramineous, ca. the length of adjacent scales, with wide hyaline margin; floral scales 1.8–2 × 0.5–0.7 mm, membranous, oval, apex acute to obtuse, spirally arranged, appressed to slightly divergent at maturity, finely striate, keel stramineous, sides stramineous to translucent white, margin hyaline; perianth bristles 5 to 6, as long as or exceeding the stylopodium, stramineous, sparsely retrorse scabrous; stamens 2, anthers 0.4–0.5 mm, ending in a short apiculum; style trifid. Achene 0.9–1 × 0.4 mm, slightly trigonous, ellipsoid to obovoid, with ca. 9 to 10 longitudinal rows of 20 to 25, horizontally oriented rectangular cells, obtuse at the apex, stramineous, iridescent; stylopodium short pyramidal, green to dark brown, separated from the achene body by a constriction, about 1/3 as wide as the achene.

Distribution and habitat. *Eleocharis riograndensis* is found in wet habitats, generally forming mats. It is possible that this species may also occur in other areas of grassland in the highlands of Rio Grande do Sul and Santa Catarina.

IUCN Red List category. *Eleocharis riograndensis* is assessed as Data Deficient (DD), according to IUCN (2001) criteria. Appropriate data on abundance and distribution are not available, so we cannot safely determine the conservation status of this species.

Discussion. *Eleocharis riograndensis* can be distinguished by the capillary and elongate culms (vs. culms flattened, more than 0.4 mm wide, and usually less than 8 cm long in *E. radicans*) and achenes with fewer rectangular cells (20 to 25 vs. 30 to 50 cells). The principal differences between *E. riograndensis* and *E. bonariensis* are the number and length of the anthers (two anthers, 0.4–0.5 mm vs. three anthers, 1.1–1.8 mm in *E. bonariensis*), the width of the culms (0.2–0.3 mm vs. 0.4–1.2 mm), and the number of flowers in the spikelets (six- to eight-flowered vs. 10- to 60-flowered).

Paratype. BRAZIL. **Santa Catarina:** Campo Alegre, Fazenda Ernesto Scheide, 1 Feb. 1957, *L. B. Smith & R. Klein 10573* (HBR, US).

KEY TO *ELEOCHARIS* SUBG. *SCIRPIDIUM* SPECIES IN BRAZIL
(ACHENE MEASUREMENTS INCLUDE THE STYLOPODIUM)

1a. Culms capillary, 0.2–0.3 mm wide; leaf sheaths with the apex long-acuminate; stamens 2, anthers 0.3–0.5 mm; rows with 20 to 25 rectangular cells ..... *E. riograndensis*
1b. Plants without the former combination of characteristics.
  2a. Anthers 0.3–0.5 mm; rows with 30 to 50 rectangular cells.
    3a. Culms 0.2–0.3 mm wide, somewhat angled; leaf sheaths with the apex inflated ..... *E. neesii*
    3b. Culms 0.4–1 mm wide, flattened; leaf sheaths with the apex acute, not inflated ..... *E. radicans*
  2b. Anthers 1–1.8 mm; rows with 50 to 70 rectangular cells.
    4a. Spikelets 8- to 10-flowered, ovoid; achenes 1.5–2.4 mm; stylopodium lanceolate, falcate ..... *E. stenocarpa* Svenson
    4b. Spikelets (7- to)10- to 55-flowered, lanceoloid, rarely ovoid; achenes 1.1–1.6 mm; stylopodium narrowly to broadly conical.
      5a. Stylopodium narrowly conical, on top of the achene neck, appearing as a continuation of the neck; floral scales hyaline to stramineous ..... *E. angustirostris*
      5b. Stylopodium conical to widely conical, distinguished from the achene body by a constriction; floral scales stramineous to light brown, generally with vinaceous spots ..... *E. bonariensis*

The inclusion of *Eleocharis stenocarpa* within *Eleocharis* subg. *Scirpidium* is based on the report and figure presented by Faria (1998). However, it is important to point out that the measurements of the achenes presented by Faria vary from 1.5 to 2.4 mm, whereas in the description presented by Svenson (1929), the measurements vary from 1.5 to 1.8 mm.

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A New Name in Brazilian *Cestrum* (Solanaceae)

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Abstract. The new name *Cestrum subumbellatum* Vignoli-Silva & M. Nee (Solanaceae) is proposed to replace the later homonym *C. campanulatum* Francey, and a lectotype is chosen. The taxon is endemic to the Atlantic Forest of eastern Brazil.

Key words: Atlantic Forest, Brazil, *Cestrum*, Solanaceae.

Considered the second largest genus of Solanaceae, *Cestrum* L. (Cestroideae, Cestreae) (Olmstead et al., 1999, 2008; Hunziker, 2001) is exclusively American, and its species are distributed in tropical and subtropical regions (Francey, 1934–1936, 1936–1938; Hunziker, 2001; Nee, 2001). The estimated species number for the entire genus is 150 (Nee, pers. obs.). Brazil is considered to have the highest species diversity, followed by the Andean regions of Bolivia, Peru, and the north of Argentina (Hunziker, 2001; Nee, 2001). The Atlantic Forest biome has the highest wealth and endemism (Nee, pers. obs.). Important characteristics for diagnosing the genus are habits ranging from shrub to tree, flowers articulated at the base, a tubular corolla, an androecium of five stamens enclosed within the tube, dorsifixed anthers, a ring-shaped nectary, and pauciseminate fruits with angular seeds, not winged and lodged into the berries. Economically, some *Cestrum* species (*C. elegans* (Brongn.) Schltdl., *C. nocturnum* L., and *C. diurnum* L.) are used ornamentally, others are used in religious rituals (*C. axillare* Vell.), and some may have medicinal applications (*C. axillare*, *C. mariquitense* Kunth, and *C. parqui* L'Hér.; see Voeks, 1997; Hawkes, 1999; Hunziker, 2001). *Cestrum strigilatum* Ruiz & Pav., *C. intermedium* Sendtn., and *C. corymbosum* Schltdl. are known to be toxic to animals (Riet-Correa et al., 1993; Tokarnia et al., 2000).

While preparing a taxonomic review of the extra-Amazonian Brazilian *Cestrum* (Solanaceae), we realized that the name *C. campanulatum* Francey, 1935, was an illegitimate later homonym to *C. campanulatum* Lam., 1785; therefore, a new name is necessary for the species. *Cestrum campanulatum* Lam. has been taxonomically placed as a synonym of *Acnistus arborescens* (L.) Schltdl. (Hunziker, 1982).

Cestrum subumbellatum Vignoli-Silva & M. Nee, nom. nov. Replaced name: *Cestrum campanulatum* Francey, Candollea 6: 294. 1935, nom. illeg., non *C. campanulatum* Lam., Encycl. 1: 688. 1785. TYPE: Brazil. "Rio de Janeiro, Serra des Orgue, fl. Octob.," *A. F. M. Glaziou 6058* (lectotype, designated here, C 59/2006/4; isolectotypes, C 59/2006/3, K 449021). Figure 1.

An amended description based on this material follows.

Shrub or tree ≤4 m tall. Leaves petiolate; blade elliptic-lanceolate to elliptic-obovate, glabrous, 4–16 × 1–4.6 cm, the apex acute or acuminate, membranaceous or chartaceous. Inflorescences axillary, cymose to subumbelliform, with a central sessile flower surrounded by pedicellate flowers, all apparently starting up at one point in the apical region of



Figure 1. *Cestrum subumbellatum* Vignoli-Silva & M. Nee. The lectotype image of *A. F. M. Glaziou 6058* (C 59/2006/4).

the inflorescence, with an umbellate aspect, and other pedicellate flowers distributed alternately along the peduncle, 2.5–6 cm long, with 3 to 6 flowers, glabrous; peduncle 0.7–4 cm, thin and delicate; pedicels 1–8 mm, thin and delicate, sometimes sinuous when dry; calyx campanulate, glabrous, 1.8–2 mm, lobes 0.1 × 0.2 mm; corolla greenish white or greenish yellow, tubular-clavate, with 10–14 mm, 2–3 mm diam. at the apex, with a constriction at the throat, the apex with triangular lobes 2–2.5 × 1–1.5

mm; filaments inserted on the upper half of the tube, with free portion 4–4.5 mm long, the base pubescent. Berry globose-ellipsoid, green when young, purple or black when mature, 0.4–0.7 × 0.3–0.4 cm; seeds 2 to 4, brown in dry material, angular, 3–4 × 2–2.5 mm.

Taxonomic comments. *Cestrum subumbellatum* is easily recognized and distinct among the ca. 26 species of the genus in Brazil by its cymose to subumbelliform inflorescence, delicate peduncle, pedicels that are eventually sinuous when dry, and corolla form and length.

The material, C 59/2006/4, designated here as a lectotype (Fig. 1), was selected because the fertile branch is most complete and is representative of the taxon. The label displays all the collection data of *Glaziou 6058* contained in the original description. The isolectotype sheet C 59/2006/3 noted only the collector and the collection number. A duplicate with the same number was found at K and probably was not seen by Francey. This sheet corresponds to the material deposited at C and is also designated as an isolectotype. The material cited by Francey (1935: 294, "in hb. Berl. et Copenh.") as deposited at B was probably destroyed in World War II (Hiepko, 1987).

Etymology. The new specific epithet *subumbellatum* is derived from the Latin *sub*, meaning "next to," "below," or "in the neighborhood," and *umbella*, or umbrella, alluding to the shape of the inflorescence's apical region.

Distribution and habitat. According to collections seen, *Cestrum subumbellatum* inhabits both the edges and interiors of humid forest up to 1450 m of altitude. It is restricted to the Atlantic Forest, in the dense ombrophilous montane forest formation (IBGE, 1992).

Additional material examined. BRAZIL. **Minas Gerais:** Alto Caparaó, Parque Nac. Caparaó, trilha para Cachoeira do Aurélio, *Machado at al. 277* (BHCB). **Rio de Janeiro:** Nova Friburgo, *Nadruz et al. 332* (RB), *Bovini et al. 1992* (ICN, RB), *Lima 525* (ICN, RB), *Siqueira 2240* (RB); Teresópolis, *Martinelli et al. 1711* (RB).

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One New and One Long-lost Species of *Eugenia* (Myrtaceae) from the Bolivian Cerrado

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Abstract. Two species of *Eugenia* L. (Myrtaceae) within *Eugenia* sect. *Umbellatae* O. Berg, *E. teresa-ruiziana* Villarroel & Faria and *E. cydoniifolia* O. Berg, are described and illustrated. The former is a new species, whereas the latter has not been collected since 1842. Both species are endemic to the cerrados of the Lomerío region of eastern Bolivia. This article examines and discusses the vegetative and reproductive characteristics that distinguish these species, which include the leaf morphology, indumentum type, secondary vein number, stamen number, and ovule number per locule.

Resumen. Dos especies de *Eugenia* L. (Myrtaceae) dentro de la *Eugenia* sect. *Umbellatae* O. Berg, *E. teresa-ruiziana* Villarroel & Faria y *E. cydoniifolia* O. Berg, se describen e ilustran. La primera es una nueva especie, mientras que la segunda no se había colectado desde 1842. Ambas especies son endémicas de los cerrados de la región de Lomerío del este de Bolivia. En este artículo se examinan y discuten las características vegetativas y reproductivas que diferencian estas especies, siendo estas: la morfología foliar, tipo de indumento, número de venas secundarias, número de estambres, y el número de óvulos por lóculo.

Key words: Bolivia, cerrado, *Eugenia*, IUCN Red List, Lomerío region, Myrtaceae, Santa Cruz.

The cerrado vegetation in Bolivia is primarily located in the eastern lowlands of the department of Santa Cruz (Killeen et al., 1993; Navarro, 2002). Floristic studies of this vegetation type are few in number and limited to specific regions (Killeen & Nee, 1991; Killeen & Schulenberg, 1998) or to single plant families (Killeen, 1990). Other recent studies have focused on the ecology of the region, and there have been no floristic inventories or taxonomic treatments. Recently, an illustrated field guide to the plants of this region was published (Wood, 2011).

In late 2007, the Department of Plant Sciences of the University of Oxford and the Noel Kempff Mercado Museum came together for a Darwin Initiative Project (#16-004) that focused on the floristic and taxonomic study of the cerrado vegetation in order to identify areas with the greatest plant diversity. This paper presents descriptions and illustrations of two species of *Eugenia* L. that were found during this project, one species new to science and the other rediscovered, having not been collected since 1842.

1. Eugenia teresa-ruiziana Villarroel & Faria, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Ñuflo de Chávez, 17 Oct. 2010 (fl.), *J. R. I. Wood & D. Villarroel 26878* (holotype, USZ; isotypes, K, LPB, UB). Figures 1, 2.

Diagnosis. The new species is most similar to *Eugenia cydoniifolia* O. Berg, but is distinguished from it by the bark that is slightly woody and fissured, the mature leaves with seven to nine pairs of secondary veins, the blades oblong or elliptic and not convex, and sericeous abaxially, the flowers with 130 to 132 stamens and with nine to 20 ovules per locule.

Trees 3–5 m; bark slightly woody and fissured; branches with cataphylls; young branches tomentose

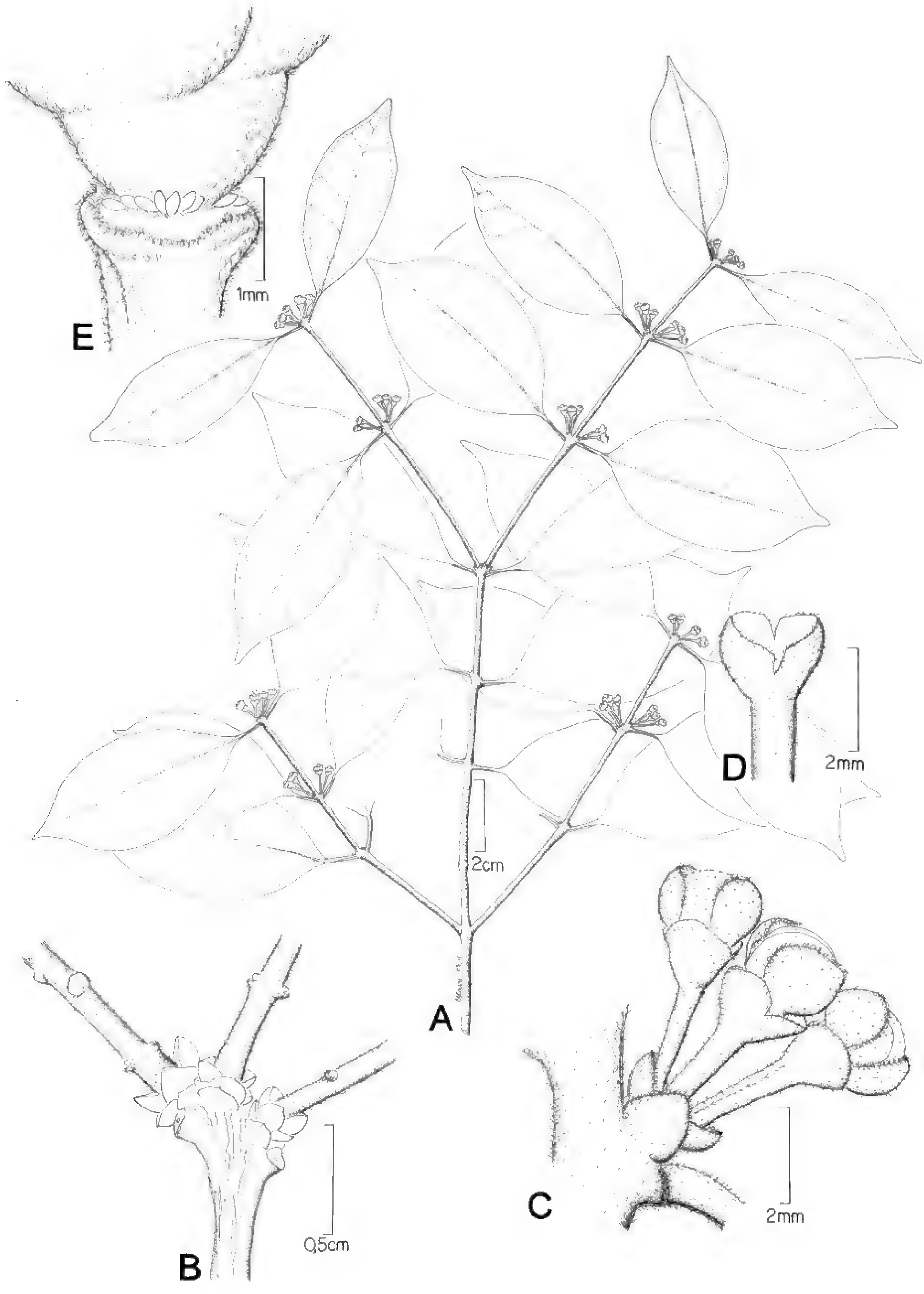


Figure 1. *Eugenia teresa-ruiziana* Villarroel & Faria. —A. Branch with axillary, subterminal and terminal. —B. Close-up of cataphylls grouped at the base of young branchlets. —C. Close-up of an inflorescence with three flowers visible. —D. Bracteoles. —E. Colleters, as seen at the base of bracteoles, the subtending bract removed. Drawn by Claudenir Simões Caires, based on the type *J. R I. Wood & D. Villarroel 26878* (UB).

apically, trichomes simple, whitish to slightly ferruginous. Leaves petiolate; leaf blades 4–8.5 × 2.4–5.2 cm, oblong or elliptical, not convex at maturity, chartaceous; apex shortly acuminate; base obtuse, slightly asymmetric; margin entire or slightly repand; adaxial surface strigose when young, trichomes simple, somewhat ferruginous, glabrescent when mature, with glands scattered, but not promi-



Figure 2. *Eugenia teresa-ruiziana*, with apex of branch showing leaves and inflorescence position. Photograph from the Darwin Initiative Project No. 16-004.

nent, on young leaves and not visible at maturity; abaxial surface tomentose when young, trichomes simple and whitish, sericeous when mature; midvein sulcate on adaxial surface, prominent on abaxial surface; secondary venation prominent on both surfaces, 7 to 9 pairs; marginal vein 2–3 mm from the margin; petioles 0.8–1.1 cm, grooved, tomentose when young, with trichomes slightly ferruginous, glabrous when mature. Inflorescence of solitary, axillary, subterminal and terminal racemes, usually umbelliform, 4- to 6-flowered when young, 3- to 5-flowered when mature (flowers fall as the inflorescence matures); floral buds pyriform, 2.5–3 × 2–2.5 mm; inflorescence bracts orbicular to deltoid, ca. 0.8–1.1 mm, tomentose on outside face, the inside surface glabrous with scattered glands except for the apex, where tomentose, with trichomes whitish to ferruginous, patent; pedicels 2–8 mm long, tomentose, trichomes whitish to ferruginous; bracteoles 1–1.4 mm, orbicular to deltoid, tomentose, free but overlapping in bud, the apex rounded or obtuse, the base with 4 to 8 short-elliptic colleters; hypanthium 1.1–1.5 mm long, tomentose, trichomes whitish; calyx lobes 4, equal, 1.5–1.6 × 1.7–2.3 mm, orbicular, apex rounded, free in bud, tomentose on both surfaces, with whitish to brown trichomes; petals 4, ca. 1.4–1.5 mm when in bud, apparently green, orbicular, apex rounded, outside puberulent, inside glabrous, glands scattered, evidently patents, margin ciliate, with whitish trichomes; stamens ca. 130 to 132, in 5 to 6 irregular verticels, the region between the verticels of stamens and the style with scattered trichomes, filaments 0.8–1.2 mm, basally pilose, glandular, anthers ovate, with an apical gland; style 2 mm long in bud, glandular; ovary 2-locular, 9 to 20 ovules per locule. Fruits 1 × 0.7 cm, apparently globose-elliptical (only old fruit observed), blackish, the bracteoles persisting until the fruit falls; seed 1, testa crustaceous, embryo elliptical-reniform.

Distribution and ecology. *Eugenia teresa-ruiziana* is known only from the Lomerío region in Ñuflo de Chávez Province in Santa Cruz Department in the eastern lowlands of Bolivia. It is apparently a rare species growing on sandy soil and on stream banks in the understory of cerrado and in areas of transition to Chiquitano dry forest.

IUCN Red List category. As *Eugenia teresa-ruiziana* is only known from two collections and the populations have never been evaluated, this species

must be categorized as Data Deficient (DD), according to IUCN (2001) criteria.

Phenology. *Eugenia teresa-ruiziana* is a deciduous tree, which loses its leaves in the dry season between July and September. The new leaves and floral buds appear simultaneously with the arrival of the first rains in October. However, the exact timing of flowering and fruiting remains uncertain.

Etymology. The specific epithet pays tribute to Teresa del Valle Ruiz de Centurion, founder of the Herbario del Oriente Boliviano (USZ), who has studied the vegetation of eastern Bolivia and promoted floristic and ecological studies of the region.

Discussion. *Eugenia teresa-ruiziana* (Figs. 1, 2) is a new species placed within *Eugenia* sect. *Umbellatae* O. Berg, according to the classification proposed by Berg (1857). *Eugenia teresa-ruiziana* and *E. cydoniifolia* are somewhat similar, especially in their indumentum type and the color of the trichomes on the young leaves (the abaxial surface has simple, whitish trichomes). However, the two species can be easily distinguished by a combination of vegetative and reproductive characters. The vegetative differences are that *E. teresa-ruiziana* is a plant with slightly woody and fissured bark (vs. woody and deeply fissured in *E. cydoniifolia*); *E. teresa-ruiziana* has branches with cataphylls (vs. without cataphylls in *E. cydoniifolia*). The leaves of *E. teresa-ruiziana* are not convex; the apex is shortly acuminate; the blade underside is sericeous when mature; and there are seven to nine pairs of secondary veins (vs. leaf blades strongly convex, apex obtuse, and abaxial blade surface with simple, whitish trichomes and four to five pairs of secondary veins in *E. cydoniifolia*). The flowers of *E. teresa-ruiziana* have 130 to 132 stamens and nine to 20 ovules per locule (vs. ca. 365 to 367 stamens and 29 to 38 ovules per locule in *E. cydoniifolia*). Moreover, *E. teresa-ruiziana* has four to eight short-elliptic colleters present at the base of the inner surface of the bracteoles, a characteristic that is absent in *E. cydoniifolia*. These structures have been found in some genera of Myrtaceae, such as in *Myrceugenia* O. Berg (Lima & Guedes-Bruni, 2004) and *Algrizea* Proença & Nic Lugh. (Sobral et al., 2010).

Paratype. Bolivia. **Santa Cruz:** Prov. Ñuflo de Chávez, Comun. Las Trancas, en la región de Lomerío, 16°58′S, 61°50′W, Nov. 1995 (fr.), *L. Arroyo 1033* (MO, USZ).

2. Eugenia cydoniifolia O. Berg, Fl. Bras. (Martius) 14(1): 229. 1857, as "cydoniaefolia." TYPE: Bolivia. Chiquitos, 1842, *D'Orbigny 783* (holotype, P; isotype, G). Figure 3.

Trees 4–7 m; bark woody, deeply fissured; young branches apically tomentose, the trichomes simple, ferruginous. Leaves petiolate; leaf blades 5–7 × 3–5 cm, opposite (on young branches subopposite), elliptic to slightly obovate, strongly convex, chartaceous; apex obtuse; base acute or obtuse; margin entire to slightly repand, hyaline; adaxial surface opaque, green, glabrous; abaxial surface tomentose, the trichomes simple, whitish; midvein sulcate on adaxial surface, prominent on abaxial surface; secondary venation prominent on both surfaces, 4 to 5 pairs, the first and second pairs eucamptodromous, the others brochidodromous, 3–5 mm from the margin; glands weakly visible on adaxial surface, not visible on the abaxial surface; petiole 0.9–1.2 cm, channeled, glabrous. Inflorescence of solitary, axillary, terminal and subterminal racemes, usually umbelliform, 2- to 4-flowered; peduncle 0–0.1 mm; floral buds pyriform, 5–6 × 5–6 mm; hypanthium tomentose; bracts 2 mm long, orbicular, tomentose on both surfaces, with whitish to ferruginous trichomes, the margin ciliate, with ferruginous trichomes; pedicels 2.5–3 mm long, tomentose, the trichomes whitish to ferruginous; bracteoles 1–1.5 mm, deltoid, free, tomentose on both surfaces, the trichomes whitish or ferruginous, persistent, sometimes even when the fruit is mature, the apex obtuse or rounded; calyx 4-lobed, in unequal pairs, ± orbicular with rounded apex, free, tomentose on both surfaces, with whitish trichomes, the inner pair of lobes larger, 3.4–4 × 3.9–5.1 mm, the outer pair smaller, 2.8–3.9 × 3.9–4.5 mm; petals four, 3.8–4.4 mm, green in bud, orbicular, rounded at the apex, with glands prominent, internally glabrous, externally tomentose, the trichomes whitish or ferruginous, margin ciliate, with ferruginous trichomes; stamens ca. 365 to 367, in 5 to 6 irregular whorls, the region between the staminal whorls and the style tomentose, with whitish trichomes; filaments 2.8–4.5 mm, glandular, anthers oblong or ovate, with an apical gland; style 5–6 mm in bud, glandular; ovary 2-locular with axillary placentation, the locule walls internally puberulent, with 29 to 38 ovules per locule. Fruit 1.1–1.3 × 1–1.2 cm, globose or elliptic, dark purple to black when mature, puberulent with scattered whitish trichomes, with glands somewhat patent, often with some surface roughness, the calyx lobes persistent; seed 1, testa crustaceous; embryo elliptical to reniform.

Distribution and ecology. *Eugenia cydoniifolia* is only known from the region of Lomerío in Ñuflo de Chávez Province, in the department of Santa Cruz,



Figure 3. *Eugenia cydoniifolia* O. Berg. —A. Habit. —B. Floral buds. —C. Detail of the deeply fissured and corky bark. —D. Fruits. Photographs from the Darwin Initiative Project No. 16-004.

Bolivia, where it was observed to grow around rock outcrops in transitional areas with Chiquitano dry forest at 530–580 m altitude.

IUCN Red List category. Because little material of *Eugenia cydoniifolia* has been seen and the probable area of occurrence has not been accurately explored, this species is categorized as Data Deficient (DD), according to IUCN (2001) criteria.

Phenology. *Eugenia cydoniifolia* is a semi-deciduous tree, which loses some of its leaves during the dry season in August and September. Its flowering and fruiting times are not known but apparently begin after the onset of the rains. A few individuals were collected and observed with flower buds in mid-October, but its flowering peak is possibly between December and February since many individuals were observed with immature and mature fruits in March.

Discussion. *Eugenia cydoniifolia* (Govaerts et al., 2008) was originally described by Berg (1857), based on a single collection made by D'Orbigny in 1842 from the Chiquitos region, a very imprecise area roughly coinciding with today's Chiquitania. Remarkably, the species was not collected again until 2009 and was later illustrated as a "*Eugenia* especie nueva" by Wood (2011). *Eugenia cydoniifolia* had not been re-collected since the mid-19th century, until fieldwork began under the project Conservation of the Cerrados of Eastern Bolivia (Darwin Project 16-004). The photograph of the type material at P (*D'Orbigny 783*) enabled us to easily identify the material recently collected as this long-lost species. A photograph of this species can also be found in Wood (2011).

Specimens examined. Bolivia. **Santa Cruz:** Prov. Ñuflo de Chávez, 50 km al S de Concepción sobre el camino a San Antonio de Lomerío, 16.5271°S, 61.9946°W, 533 m, 17 Mar. 2009, *J. R. I. Wood et al. 25747* (K, LPB, UB, USZ); 16°31′37″S, 61°59′41″W, 539 m, 17 Oct. 2010, *J. R. I. Wood & D. Villarroel 26890* (K, LPB, UB, USZ); Prov. Ñuflo de Chávez, Comunidad El Encanto en la región de Lomerío, 18 Mar. 2009, *J. R. I. Wood, D. Villarroel & S. Renvoize 25775* (K, LPB, UB, USZ).

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Sinojohnstonia ruhuaii (Boraginaceae), a New Species from Jiangxi, China

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ABSTRACT. *Sinojohnstonia* Hu (Boraginaceae, Trigonotideae) is endemic to China and previously included only three species. *Sinojohnstonia ruhuaii* W. B. Liao & Lei Wang, a new species from Jiangxi, China, is described and illustrated. The new species is most closely related to *S. chekiangensis* (Migo) W. T. Wang by its morphology and differs in that its flowers are smaller, the corolla limb is slightly shorter than or nearly as long as the tube, and the stamens are positioned below the throat appendages. A key is provided to distinguish the four species of *Sinojohnstonia* now recognized.

Key words: Boraginaceae, China, IUCN Red List, Jiangxi, *Sinojohnstonia*.

Sinojohnstonia Hu (Boraginaceae) has included only three species (Zhu et al., 1995; Mabberley, 2008) that are endemic to China. *Sinojohnstonia moupinensis* (Franch.) W. T. Wang is distributed among the provinces of Gansu, Ningxia, Shaanxi, Shanxi, Hubei, Hunan, Sichuan, Yunnan; *S. plantaginea* Hu is found in southeastern Gansu and Sichuan provinces; and *S. chekiangensis* (Migo) W. T. Wang occurs in the provinces of Zhejiang, Jiangxi, Hunan, Shaanxi, and Shanxi (Zhu et al., 1995). Herein we describe a new species in *Sinojohnstonia* from Mt. Sanqing in Jiangxi province of China. In its entirety, *Sinojohnstonia* occurs in northwestern to central areas in China, and also to the east and southwest.

In October 2009, Professor Ru-huai Miao identified a specimen of Boraginaceae collected in the province of Jiangxi in April 2007 as a new species of *Omphalotrigonotis* W. T. Wang. He used the ined. epithet "leucopetalus" based on the white corolla, but did not go on to formally describe and validate the name. The current authors re-examined this specimen in January 2012 and concluded that the new species is better assigned to *Sinojohnstonia* based on the ovate to cordate leaf blades and a fruiting calyx that was extremely enlarged and enclosed the fruit. In contrast, *Omphalotrigonotis* has leaf blades that are elliptic to ovate, and its fruiting calyx is slightly enlarged and does not enclose the fruit. Nonetheless, *Sinojohnstonia* and *Omphalotrigonotis* are closely related and share the common feature in that their nutlets are tetrahedral, with the abaxial margin exserted as a membranous cupule. Both these genera belong to tribe Trigonotideae, subfamily Boraginoideae, mainly on the basis of the nutlet morphology as tetrahedral or lenticular and pollen morphology (Zhu et al., 1995; Riedl et al., 1997).

Sinojohnstonia ruhuaii W. B. Liao & Lei Wang, sp. nov. TYPE: China. Jiangxi: Mt. Sanqing [Sanqingshan], Jinshayulian waterfall, 28°55′N, 118°06′E, 560 m, 2 Apr. 2007, *Team of Mt. Sanqingshan of Sun Yat-sen University 19117* (holotype, SYS). Figures 1–3.

Haec species *Sinojohnstoniae chekiangensi* (Migo) W. T. Wang similis, a qua floribus minoribus, corollae lobis tubo paulo brevioribus subaequilongisve et staminibus paullulum e tubo corollae exsertis infra appendices paulo posticas differt.

Herbs perennial; plants with several rhizomes; stems several, prostrate to spreading, 10–40 cm tall, sparsely short strigose. Leaves alternate, the blade ovate, base cordate or slightly flattened truncate or deltoid, apex acuminate or acute, densely strigose abaxially and adaxially; basal leaves several, with petioles 5–10 cm, lamina 4–6 × 2–3 cm; cauline leaves, with petioles 1–8 cm, lamina 2–6 × 1–3 cm. Inflorescences terminal, racemose with 2 or 3 branches, ca. 3–5.5 cm, densely short strigose, to 8-



Figure 1. Holotype specimen of *Sinojohnstonia ruhuaii* W. B. Liao & Lei Wang (*Team of Mt. Sanqingshan of Sun Yat-sen University 19117*, SYS).

or 9-flowered, ebracteate. Calyx in flower ca. 3–3.5 mm, slightly longer than corolla tube, 5-parted to base; lobes linear-lanceolate; densely strigose abaxially and adaxially; in fruit enlarging to 8–10 mm and becoming saccate. Corolla white or light reddish white, campanulate, ca. 5–6 mm, glabrous; corolla limb 5-parted, spreading, slightly shorter than or nearly as long as corolla tube; lobes ovate; throat appendages 5,



Figure 2. Paratype specimen of *Sinojohnstonia ruhuaii* W. B. Liao & Lei Wang (*Team of Mt. Sanqingshan of Sun Yat-sen University 19108*, SYS).

semi-orbicular, ca 0.2–0.3 mm, bottom connected to the lower corolla lobes; stamens 5, inserted on upper part of corolla tube, anthers slightly exserted from the corolla tube, but below the throat appendages; filaments ca. 0.5 mm; anthers oblong, ca. 0.6–0.8 mm. Ovary deeply 4-lobed; style ca. 2.5–4 mm; stigma capitate. Fruit a nutlet, tetrahedral, ca. 3–3.8 × 2–3 mm, glabrous; nutlet with abaxial membranous

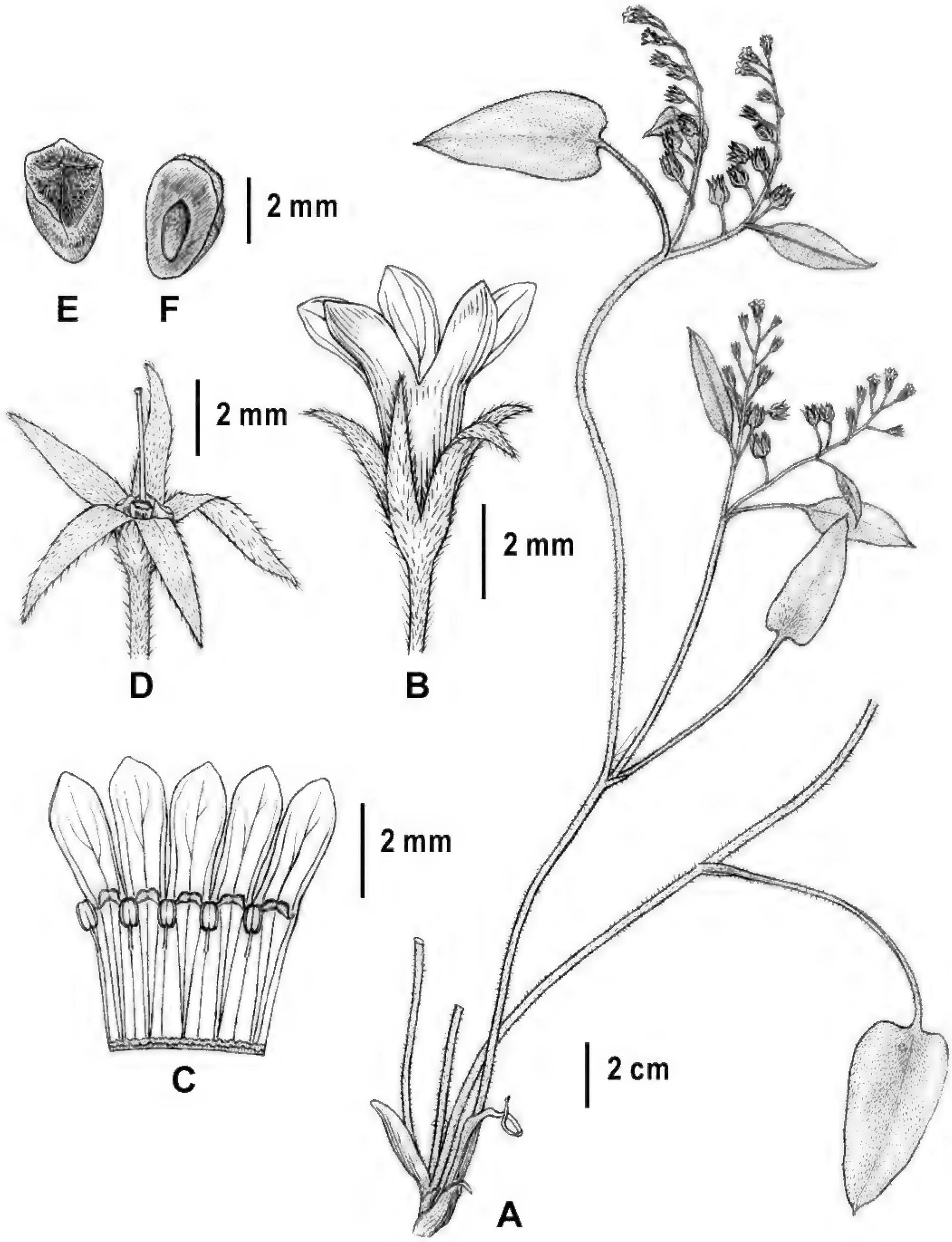


Figure 3. *Sinojohnstonia ruhuaii* W. B. Liao & Lei Wang. —A. Habit. —B. Flower with calyx and corolla. —C. Corolla and stamens. —D. Calyx and pistil. —E. Nutlet, ventral view. —F. Nutlet, dorsal view. A–E drawn from the type *Team of Mt. Sanqingshan of Sun Yat-sen University 19117* (SYS).

margin-inflexed cupular emergence; attachment scar slightly below middle of adaxial surface.

Etymology. The epithet *ruhuaii* honors Professor Ru-huai Miao (1943–) who was the first botanist to recognize the new species. Professor Miao is a specialist in the floras of Hainan and southern China, as well as the taxonomy of the Elaeocarpaceae and Myrtaceae.

Phenology. *Sinojohnstonia ruhuaii* can be observed to flower and fruit from March to July.

Distribution and habitat. *Sinojohnstonia ruhuaii* occurs on Mt. Sanqing in northeastern Jiangxi province (type locality) and possibly also occurs in Mt. Tongbai in southern Henan province, Jixi county in southeastern Anhui province, and Mt Qingliangfeng and Hangzhou city in Zhejiang province, inferred from the internet images in which *S. ruhuaii* was wrongly determined as *S. chekiangensis* or *S. moupinensis*. *Sinojohnstonia ruhuaii* has been observed to grow on a shaded, moist rocky slope beside a ravine stream at an altitude of ca. 400–800 m.

IUCN Red List category. Despite the careful return of the authors to the type locality on Mt. Sanqing in 2013, only three populations in the Jinshayulian waterfall area and one population in Shiguling were found. The habitat of *S. ruhuaii* is narrow and the number of individuals is low. Otherwise, the known occurrences of *S. ruhuaii* are in the nature reserves or in the botanic garden. According to IUCN Red List criteria (2001), *S. ruhuaii* would fall under the Near Threatened (NT) assessment category.

Relationships. The flowers of *Sinojohnstonia ruhuaii* easily distinguish it from the other three species of the genus. Morphologically, the closest relative of this species is *S. chekiangensis*. The new species differs from *S. chekiangensis* in that its flowers are smaller, 5–6 mm (vs. 1 cm in *S. chekiangensis*), the corolla limb is slightly shorter than or nearly as long as corolla tube, and the stamens are slightly exserted from the tube and lie below the throat appendages (vs. being distinctly exserted from the tube and upon the throat appendages).

Paratype. CHINA. **Jiangxi:** Mt. Sanqing [Sanqingshan], Jinshayulian waterfall, 28°55′N, 118°06′E, 560 m, 2 Apr. 2007, *Team of Mt. Sanqingshan of Sun Yat-sen University 19108* (SYS).

Additional specimens examined. CHINA. **Jiangxi:** Mt. Sanqing [Sanqingshan], Jinshayulian waterfall, 28°55′N, 118°06′E, 560 m, 12 Apr. 2014, *Wenbo Liao, 2014-L0310, 2014-L0314, 2014-L0317*; Jinshayulian waterfall valley, slope near river bank, 423 m, 2 Nov. 2013, *Wenbo Liao & Lei Wang, 2013-L048*; and Sanqingshan, Shiguling, 400 m, beside the water streams of valley, 4 Nov. 2013, *Wenbo Liao & Lei Wang, 2013-L007* (SYS).

The following key includes the new species and the other three known species of *Sinojohnstonia* (modified from Zhu et al., 1995).

Taxonomic Key to *Sinojohnstonia* in China.

1a. Stamens included within the corolla tube; corolla limb distinctly longer than tube; throat appendages basally connected to the upper corolla tube and higher than stamens, nutlets pubescent; plants without rhizomes ..... 1. *S. moupinensis*
1b. Stamens exserted from the corolla tube; corolla limb slightly longer to shorter than tube; throat appendages basally connected to the lower corolla lobes; nutlets glabrous or sparsely pubescent; plants with rhizomes 2
2a. Corolla lobes narrowly triangular, ca. as long as tube; stamens inserted on throat between appendages, slightly shorter to longer than corolla ..... 2. *S. plantaginea*
2b. Corolla lobes ovate to oblong; stamens inserted on the upper corolla tube 3
3a. Corolla lobes distinctly shorter than tube; stamens distinctly exserted from corolla tube and upon throat appendages ..... 3. *S. chekiangensis*
3b. Corolla lobes slightly shorter than or nearly as long as tube; stamens slightly exserted from corolla tube and below throat appendages ..... 4. *S. ruhuaii*

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Chrysanthemum zhuozishanense (Compositae), a New Species in Section *Chrysanthemum* from Inner Mongolia, China

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ABSTRACT. *Chrysanthemum zhuozishanense* L. Q. Zhao & J. Yang, a new species (Compositae) from Inner Mongolia, China, is described and illustrated. It appears most closely related to *C. lavandulifolium* (Fisch. ex Trautv.) Makino but is distinguished by its capitula 8–10 mm diam., the white or pink ray florets, the lamina 4–5 mm, and the style branches with the truncate and papillose apex. Plants are densely pubescent throughout, with simple trichomes. The new species is assigned to *Chrysanthemum* L. sect. *Chrysanthemum* on the basis of the phyllaries with brown scarious margins.

Key words: China, *Chrysanthemum*, Compositae, Inner Mongolia, IUCN Red List.

There are ca. 37 species of *Chrysanthemum* L. (Compositae) worldwide (Zhu et al., 2011) that are chiefly distributed in temperate Asia. Twenty-two species are known from the Chinese flora, with 13 of these endemic; eight species are found in Inner Mongolia. In September 2008, Zhao and Yang collected the specimens of *Chrysanthemum* from Zhuozishan (Albasi) in Ordos, Inner Mongolia, China. Similar specimens were also collected from the same location in 2012. After careful study, we conclude that the specimens represent an undescribed species of *Chrysanthemum*.

Chrysanthemum zhuozishanense L. Q. Zhao & J. Yang, sp. nov. TYPE: China. Inner Mongolia: Ordos, Mt. Albasi, 39°38′12.1″N, 106°58′53.8″E, 2080 m, 6 Sep. 2008, *L.-Q. Zhao 08-001* (holotype, HIMC). Figure 1.

Haec species *Chrysanthemo lavandulifolio* (Fisch. ex Trautv.) Makino affinis, sed ab eo planta pubescente trichomatibus simplicibus, capitulis 8–10 mm diam., flosculis radii albis vel roseis laminis 4–5 mm longis et ramis styli apice truncatis papillosis differt.

Herbs, perennial, 15–35 cm tall, densely and thickly appressed pubescent throughout, gradually glabrescent at anthesis, occasionally arising from procumbent rhizomes; stems erect, sometimes from procumbent bases, solitary or corymbosely branched above middle or only in upper third, occasionally from base; lower stem leaves withered at anthesis; middle stem leaves, with petiole ca. 0.5–1 cm, with basal lobes; leaf blade flabellate or suborbicular, 0.5–1.5 × 0.5–1.5 cm, both surfaces densely glandular, abaxially grayish white, adaxially grayish green, 2-pinnatipartite or 2-palmate pinnately divided; distal stem leaves smaller, tripartite or entire. Synflorescence a lax cyme; capitula 8–10 mm diam.; involucres cup-shaped, 5–7 mm diam., with the phyllaries in 4 rows, abaxially pubescent, outer ones linear, ca. 1.8 mm, grayish green, obtuse and scarious at apex, middle phyllaries lanceolate, ca. 3 mm, inner ones elliptic, ca. 4 mm, phyllary margins brown, broadly scarious. Ray florets white or pink, corolla lamina elliptic, 4–5 mm; disk florets ca. 2.5 mm; anthers ca. 1 mm, subacute at base, apical appendages subtriangular, ca. 0.3 mm; style branches with the apex truncate, papillose. Achenes ca. 1.7 mm, obovoid, faintly 5- to 8-ribbed; pappus absent.

Habitat and distribution. *Chrysanthemum zhuozishanense* is known only from the wet northern slopes of Zhuozishan (Albasi) in Ordos, Inner Mongolia, at altitudes from 2000 to 2140 m, where it was collected from sparse shrub and meadow.

IUCN Red List category. *Chrysanthemum zhuozishanense* is presently known only from the five collections cited in this paper. The collection locality of Zhuozishan (Albasi) has a total area of ca. 2368 km^2 with a mean altitude of 1800 m. The main part of the mountain runs north to south, with the highest peak being 2149 m. Zhuozishan (Albasi) is located in a steppe desert region, with an annual rainfall less than 200 mm. *Chrysanthemum zhuozishanense* is currently found only in the relative humid habitat of the mountain, between 2000 and 2140 m, close to the main peak. The number of mature plants of the new species is low, but *C. zhuozishanense* breeds and seeds well and is therefore assessed as Vulnerable (VU), according to IUCN (2001) criteria.

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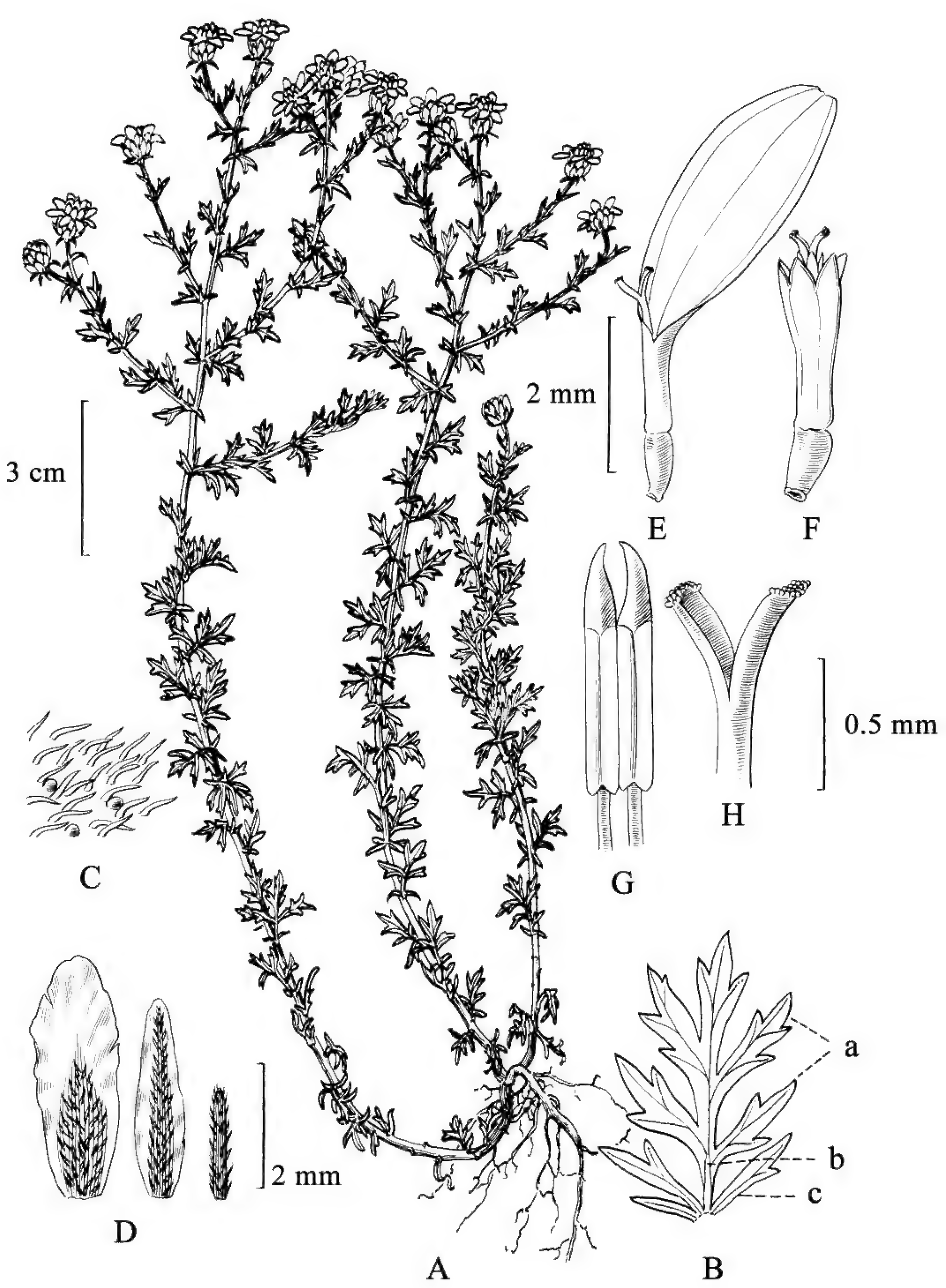


Figure 1. *Chrysanthemum zhuozishanense* L. Q. Zhao & J. Yang. —A. Fertile plant. —B. Leaf, with (a) blade, (b) petiole, and (c) divided basal lobes. —C. Glands and pubescence on both surfaces of the leaf. —D. Phyllaries, with inner, middle, and lower shown from left to right. —E. Ray floret. —F. Disk floret. —G. Stamen. —H. Style branches. Drawn by P. Ma from the holotype *L. Q. Zhao 08-001* (HIMC).

Phenology. *Chrysanthemum zhuozishanense* has been observed to flower and fruit from August to October.

Discussion. *Chrysanthemum zhuozishanense* resembles *C. lavandulifolium* in its similar capitulum that is smaller, with shorter ray florets, and pubescent plants that are gradually glabrescent at anthesis. The new species is easily distinguished by the white or pink ray corollas (vs. yellow in *C. lavandulifolium*). Both species have styles with truncate apices, but the apices are papillose in *C. zhuozishanense* (vs. penicillate in *C. lavandulifolium*). Plants of both species are pubescent, with dense indument composed of glands and simple trichomes in *C. zhuozishanense*, but the indument in *C. lavandulifolium* differs with its forked trichomes. *Chrysanthemum lavandulifolium* is distributed across northeastern and northern China and into central and southwestern China. In Inner Mongolia, *C. lavandulifolium* is distributed across Chifeng, Tongliao, and Hohhot, and east of Ordos; in contrast, *C. zhuozishanense* has a restricted distribution west of Ordos.

Key to *Chrysanthemum* Species in Inner Mongolia, China

1a. Outer and sometimes middle phyllaries herbaceous, pinnatilobed or pinnatifid ..... 9. *C. mongolicum* Y. Ling
1b. Phyllaries with white, brown, or dark scarious margins.
  2a. Ray florets yellow; capitula several to many, cymose.
    3a. Leaf blade pinnatifid, pinnatilobed, or inconspicuously divided ..... 1. *C. indicum* L.
    3b. Leaf blade 2-pinnatisect, 2-pinnatipartite, or inconspicuously 2-pinnatipartite, primary lateral segments 2 or 3(or 4) pairs ..... 2. *C. lavandulifolium*
  2b. Ray florets white, pink, or purple-red, capitula solitary or several to many, lax cyme.
    4a. Leaf blade palmately or pinnately 3- to 7-divided or palmate pinnately 3- to 7-divided.
      5a. Leaf blade reniform, suborbicular, or broadly ovate, base somewhat cordate or truncate. . . . . 3. *C. chanetii* H. Lév.
      5b. Leaf blade elliptic, narrowly elliptic, or ovate, base cuneate or broadly cuneate . . . . 4. *C. naktongense* Nakai
    4b. Leaf blade bipalmate-pinnatifid, bipinnatifid.
      6a. Capitula 8–10 cm in diam., involucres 5–7 mm diam . . . . 8. *C. zhuozishanense* L. Q. Zhao & J. Yang
      6b. Capitula 2–5 cm in diam., involucres 8–20 mm diam.
        7a. Leaves bipalmate, bipalmate pinnately divided, or biternate-pinnatisect; capitula solitary, rarely 2 to 5; stems densely villous or pubescent ..... 7. *C. oreastrum* Hance
        7b. Leaves bipinnatifid; capitula 2 to 5, in lax cymes, rarely solitary; stems sparsely pubescent.
          8a. Primary lobes of leaf blade pinnatilobed or pinnatifid, ultimate lobes triangular or obliquely triangular, ca. 3 mm wide; apex of ray floret entire or minutely emarginated ..... 5. *C. zawadskii* Herbich
          8b. Primary lobes of leaf blade pinnatisect or subpinnatisect, ultimate lobes linear or narrowly linear-lanceolate, 1–2 mm wide; apex of ray floret minutely 3-denticulate . . .. 6. *C. maximowiczii* Kom.

Paratypes. CHINA. **Inner Mongolia:** Ordos, Mt. Zhuozishan (Albasi), 19 Sep. 2012, *L.-Q. Zhao 12-001*, *12-002*, *12-003*, *12-004* (HIMC).

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NOVON

Smilax silverstonei, una Nueva Especie de Smilacaceae del Suroccidente de Colombia

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RESUMEN. Se ilustra y describe del Valle del Cauca, Nariño y Cauca una nueva especie de *Smilax* L. (*S. silverstonei* Botina, Smilacaceae) del suroccidente de Colombia (Cauca, Nariño y Valle del Cauca), la cual se diferencia de las demás especies conocidas de *Smilax* del Neotrópico por los tricomas híspidos presentes en sus tallos y ramas.

ABSTRACT. A new species of *Smilax* L. (Smilacaceae) in southwestern Colombia (Cauca, Nariño, Valle del Cauca) is illustrated and described from Valle del Cauca, Nariño, and Cauca. *Smilax silverstonei* Botina differs from all other known Neotropical species of *Smilax* by the hispid trichomes present on the stems and branches.

Key words: Cauca, Colombia, IUCN Red List, Nariño, Neotrópico, Smilacaceae, *Smilax*, Valle del Cauca.

En años recientes, la composición de Smilacaceae, con los géneros *Smilax* L., *Heterosmilax* Kunth y *Rhipogonum* J. R. Forst & G. Forst (Koyama, 1960, 1984; Conran, 1998), ha sido aceptada por la mayoría de los botánicos. Sin embargo, análisis cladísticos con base en datos morfológicos, moleculares y palinológicos sugieren la exclusión de *Rhipogonum* de Smilacaceae y la inclusión de *Heterosmilax* en *Smilax* (Cameron & Fu, 2005; Chen et al., 2006a, 2006b). Actualmente se acepta *Rhipogonum* como familia independiente (Rhipogonaceae), y *Smilax* y *Heterosmilax* los géneros que componen Smilacaceae (Stevens, 2001–2014).

Cameron y Fu (2005) estimaron en alrededor de 200 el número de especies del género *Smilax* en el mundo; el país con más especies es China con 79, seguido de Brasil con 31 y la región de Norteamérica al norte de México con 20. Recientemente Ferrufino (2010) reconoció un total de 29 especies para América Central y las islas del Caribe. En el Neotrópico podrían existir alrededor de 100 especies, después de resolver una notoria sinonimia y delimitar acertadamente un buen número de especies, además de los taxones nuevos que se describan, especialmente en Suramérica.

Una de las regiones Neotropicales donde existe mayor vacío de conocimiento taxonómico del género *Smilax* es el norte de Suramérica (Bolivia, Perú, Ecuador, Colombia y Venezuela). Durante mi revisión del grupo en Colombia se encontraron 16 especies, incluida una especie nueva, la cual se describe aquí.

Smilax silverstonei Botina, sp. nov. TIPO: Colombia. Valle del Cauca: Mpio. Dagua, cerca de la Finca Villa Carolina, Parcelación El Ensueño, Cordillera Occidental, vertiente occidental, 3°33′49″N, 76°36′12″W, 1825 m, 20 Nov. 1999, *P. A. Silverstone-Sopkin & N. Paz 8374* (holotipo, CUVC-33996 [hojas, pliego 1 de 2], CUVC-33997 [infrutescencias, pliego 2 de 2; vea McNeill et al., 2012: Art. 8.3 ex. 4]; isotipos, COL, CUVC, MO). Figura 1.

Haec species ab aliis speciebus neotropicis *Smilacis* L. trichomatibus hispidis caulium et ramorum maturorum differt.

Liana; tallo usualmente semiterete, anguloso, 10 ángulos poco pronunciados en la base, 15–18 mm

diám. en los entrenudos basales, estriado, escabroso, verde oscuro en la base, verde oliva en el ápice, nudos abultados en los sitios donde salen las hojas; tricomas híspidos generalmente dispersos, simples o rara vez furcados, rectos, hasta 5 mm, color verde oscuro en la parte proximal, café claro en la parte distal; acúleos rectos, aplanados, 5–9 mm los más desarrollados, localizados en los ángulos del tallo, verde oscuro hacia la base y café claro en el ápice; ramas angulosas o semiteretes, escabriúsculas, estriadas, tricomas híspidos cortos, abundantes, usualmente rectos, blanquecinos; acúleos pequeños, semiteretes o algo aplanados, rectos, escasos. Hojas bien desarrolladas con lámina ovada o cordada, buladas por la haz, glabras, coriáceas, trinervadas, 18–31 × 8.4–21 cm, margen entero, ápice acuminado, base redondeada o cordada; nervios 7, las de menor desarrollo 5, el par externo submarginal, nervios primarios y retículos conspicuos en el envés, inconspicuos en la haz; pecíolos geniculados, angulosos, 2.6–4.8 cm, color en fresco café claro o rojizo, usualmente con tricomas híspidos cortos y dispersos, vaina con alas auriculadas en el ápice de hojas con buen desarrollo, 10–25 × 5–15 mm en la aurícula; zarcillos teretes, con tricomas híspidos cortos y muy escasos. Flores femeninas y masculinas no vistas. Infrutescencia un racimo de cimas umbeliformes; pedúnculos planos, (3–)14–45 × 1–3 mm, pedúnculos de segundo orden de cimas umbeliformes apicales a veces ausentes, receptáculo arriñonado, pero casi globoso en las cimas apicales, (1–)4–8 mm diám. ecuatorial, pedicelos (7–)12–19 mm de longitud. Frutos globosos, 6 a 12 por cima umbeliforme, anaranjados, algo opacos, 14–19 × 9–19 mm.

Distribución y hábitat. *Smilax silverstonei* es conocida solamente de Colombia, de la vertiente occidental de la Cordillera Occidental, en los departamentos de Cauca, Nariño y Valle del Cauca. Las localidades donde se ha hallado se localizan entre 1580 y 1825 m de altitud, y presentan valores de precipitación anual entre 1700 mm (en la Reserva Natural El Refugio, cerca de la localidad tipo) y más de 4000 mm (en la Reserva Natural La Planada y la Reserva Natural El Tambito), mientras que la temperatura promedio anual es de 12°C a 24°C; en consecuencia, el área de distribución de la especie corresponde, de acuerdo con el sistema de clasificación de Holdridge (1967), a las zonas de vida comprendidas entre bosque húmedo premontano y bosque pluvial premontano.

Categoría de amenaza de la UICN. Aunque *Smilax silverstonei* se registra en sólo cinco localidades, con una distancia de separación aproximada de 10 a 300 km entre ellas, se la incluye en la categoría de amenaza Preocupación Menor (LC) de la UICN (2001), ya que se encuentra en las áreas protegidas Reserva Natural La Planada (Nariño), Reserva Natural El Tambito (Cauca), Reserva Forestal Regional Bitaco (Valle del Cauca) y Parque Nacional Natural Los Farallones (Valle del Cauca).

Fenología. *Smilax silverstonei* se ha colectado con frutos en los meses de agosto, septiembre, octubre y noviembre. De acuerdo con los datos de precipitación de la Reserva Natural El Tambito (García & Pardo, 2004), parece que la fructificación de la especie coincide con la temporada de mayor precipitación del año.

Etimología. Especie dedicada al Profesor Philip Arthur Silverstone-Sopkin, del Departamento de Biología de la Universidad del Valle en Cali, Colombia, quien colectó el material tipo y ha contribuido con sus numerosas colecciones botánicas al conocimiento de la flora del suroccidente colombiano.

Discusión. *Smilax silverstonei* se diferencia de las demás especies Neotropicales de *Smilax* por la presencia de tricomas híspidos, principalmente en el tallo y las ramas, los cuales miden hasta 5 mm de longitud en la parte basal del tallo. Las vainas peciolares con alas auriculadas en el ápice, en las hojas con mayor desarrollo, constituyen una característica complementaria distintiva de la especie. Se denomina ala de la vaina a la porción de ésta, próxima a los zarcillos, que se expande perpendicularmente al eje del pecíolo hasta 15 mm (Sipman, 1979; Mitchell, 1997; Gaskin & Berry, 1998).

Por la escabrosidad de su tallo y ramas maduras, conferida por los tricomas híspidos, y por el arreglo racimoso de sus infrutescencias, *Smilax silverstonei* se asemeja a primera vista con *S. schomburgkiana* Kunth, pero lo escabroso de la segunda se debe a la presencia de tubérculos, los cuales no se encuentran en *S. silverstonei*. La vaina peciolar con alas visibles es un carácter importante en *S. siphilitica* Humb. & Bonpl. ex Willd. (Gaskin & Berry, 1998), pero a diferencia de ésta, en *S. silverstonei* las alas son auriculadas en el ápice de la vaina. Además de *S. schomburgkiana*, infrutescencias con disposición racimosa también se hallan en *S. siphilitica* y en algunos ejemplares de *S. febrifuga* Kunth, pero ninguno de estos taxones, presentes en Colombia y no simpátricos con *S. silverstonei*, exhibe indumento, salvo algunos especímenes de *S. siphilitica*, que tienen el tallo ligeramente tuberculado.

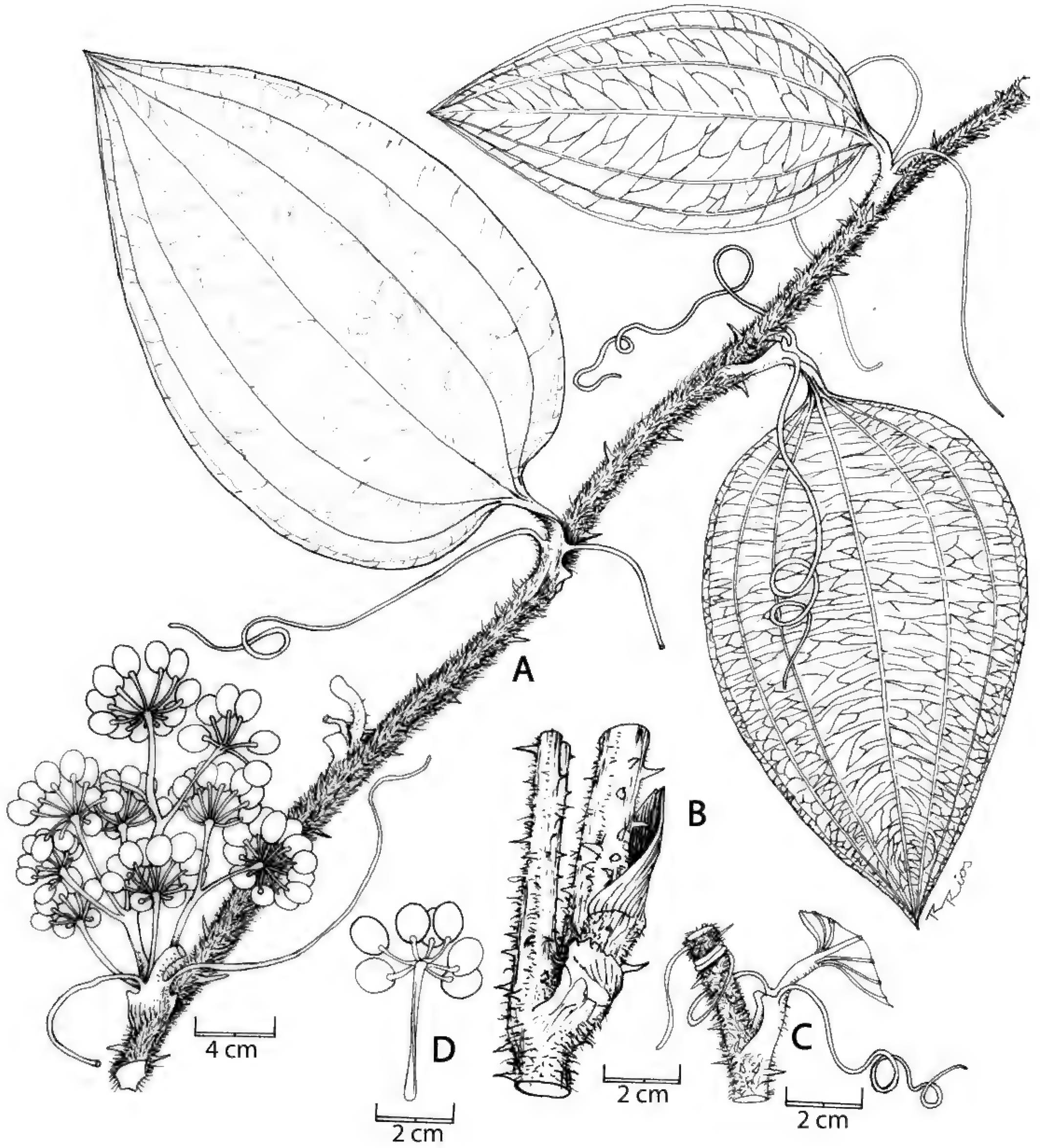


Figura 1. *Smilax silverstonei* Botina. —A. Porción de rama con infrutescencias. —B. Tallo aculeado con tricomas híspidos dispersos. —C. Vaina peciolar de hoja joven. —D. Infrutescencia. Dibujos de Raúl Ríos con base en el holotipo, A y D, *P. A. Silverstone-Sopkin & N. Paz 8374* (CUVC), y el paratipo, B y C, *J. R. Botina & L. García 815* (CUVC).

Aunque *Smilax schomburgkiana* está pobremente representada en Colombia, pues disponemos de un solo espécimen procedente de la región Amazónica, en límites con Brasil y Perú, por las descripciones de este taxón en Surinam (Sipman, 1979), Guayana Francesa Central (Mitchell, 1997), Guayana Venezolana (Gaskin & Berry, 1998, 2005) y Guyana (Andel, 2000), y el estudio de algunos tipos (*Hostmann 954*, K; *Hostmann 997*, G, K, P; *Gleason 294*, US), no hay duda de que *S. silverstonei* es diferente de *S. schomburgkiana*, con base en las diferencias notables en el indumento y en la forma de las vainas.

Paratipos. COLOMBIA. **Cauca:** Mpio. El Tambo, Reserva Nat. El Tambito, 1600 m, 11 Sep. 1999, *R. A. Serna, N. Gómez & O. L. Casañas 972* (CAUP), Vda. 20 de Julio, 1580 m, 23 ago. 1999, *R. A. Serna, N. Gómez & O. L. Casañas 893* (CAUP). **Nariño:** Mpio. Ricaurte, a 7 km de Chucunés, Reserva Nat. La Planada, creciendo en claro de bosque, 1°10′N, 77°58′W, 1800 m, 12 ago. 1992, *R. Giraldo 166* (HUA, PSO), en parcela 1 de Constanza Ríos, 23 ago. 1994, *H. Mendoza 723* (PSO). **Valle del Cauca:**

Mpio. La Cumbre, Vda. Chicoral, Reserva Alto Bitaco, 1800 m, 10 oct. 2007, *T. Cano 66* (CUVC); Mpio. Dagua, Cgto. Queremal, ca. límite del Parque Nac. Nat. Los Farallones, orilla margen izquierda aguas abajo de la Qbda. San Juan, 3°29′20″N, 76°42′23.6″W, 1727 m, 21 Sep. 2008, *J. R. Botina P. & L. García 815* (CUVC).

Agradecimientos. Mis agradecimientos para el Kew Latin America Research Fellowships (KLARF) Programme, por concederme un Andrew W. Mellon Latin America Botanic Fellowship 2004 para estudiar colecciones de *Smilax* del Neotrópico en 10 herbarios europeos. La International Association for Plant Taxonomy, Missouri Botanical Garden y New York Botanical Garden financiaron parcialmente una visita a cuatro herbarios de Estados Unidos, la primera mediante un IAPT Research Grant in Plant Systematics 2003, y el segundo y tercero concediéndome alojamiento en sus apartamentos de visitantes. A los curadores de los herbarios europeos B, BM, BR, G, K, LE, M, MA, P y U, los herbarios estadounidenses F, MO, NY y US, los herbarios ecuatorianos Q y QCNE, y los herbarios colombianos CAUP, COAH, COL, CUVC, HUA, HUQ, JAUM, MEDEL, PSO, TOLI, TULV, UTMC y VALLE, por haberme permitido el estudio de sus colecciones de *Smilax*. El Programa de Postgrado en Ciencias-Biología de la Universidad del Valle me apoyó financieramente mediante cuatro becas de asistencia de docencia mientras adelantaba mis estudios de postgrado. La figura del nuevo taxón fue realizado por Raúl Ríos. Bárbara A. Silverstone aportó ayuda valiosa durante mi estadía en París. El Profesor Philip A. Silverstone-Sopkin tradujo al Latín la diagnosis de la especie e hizo sugerencias para mejorar el manuscrito, a quien agradezco, además, sus consejos y oportuna ayuda.

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Two New Species of *Passiflora* subg. *Decaloba* (Passifloraceae) from Peru and Bolivia

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ABSTRACT. Two new species were found during a taxonomic revision of *Passiflora* subg. *Decaloba* (DC.) Rchb. (Passifloraceae). Both new species are described and placed in the *P. lobbii* Mast. species group. *Passiflora joergenseniana* T. Boza is from La Paz, Bolivia, and *P. praemorsa* T. Boza is from Cusco, Peru, and is also distributed in La Paz, Bolivia. Conservation assessments and geographic distributions for each species are provided, and morphological variability within each species is discussed. Similarities to and differences among these new species and putative close relatives are also examined.

RESUMEN. Dos especies del genero *Passiflora* L. fueron encontradas durante la revisión taxonómica del subg. *Decaloba* (DC.) Rchb. Ambas especies novas son descritas y situadas en el grupo de especies de *P. lobbii* Mast. *Passiflora joergenseniana* T. Boza es de La Paz, Bolivia y *P. praemorsa* T. Boza es de Cusco, Perú y también está distribuida en La Paz, Bolivia. El estado de conservación, la distribución geográfica y la variabilidad morfológica dentro de cada especie se discute. Similitudes y diferencias entre estas nuevas especies y su especies cercanas son también examinados.

Key words: Bolivia, IUCN Red List, *Passiflora*, *Passiflora lobbii* species group, Passifloraceae, Peru.

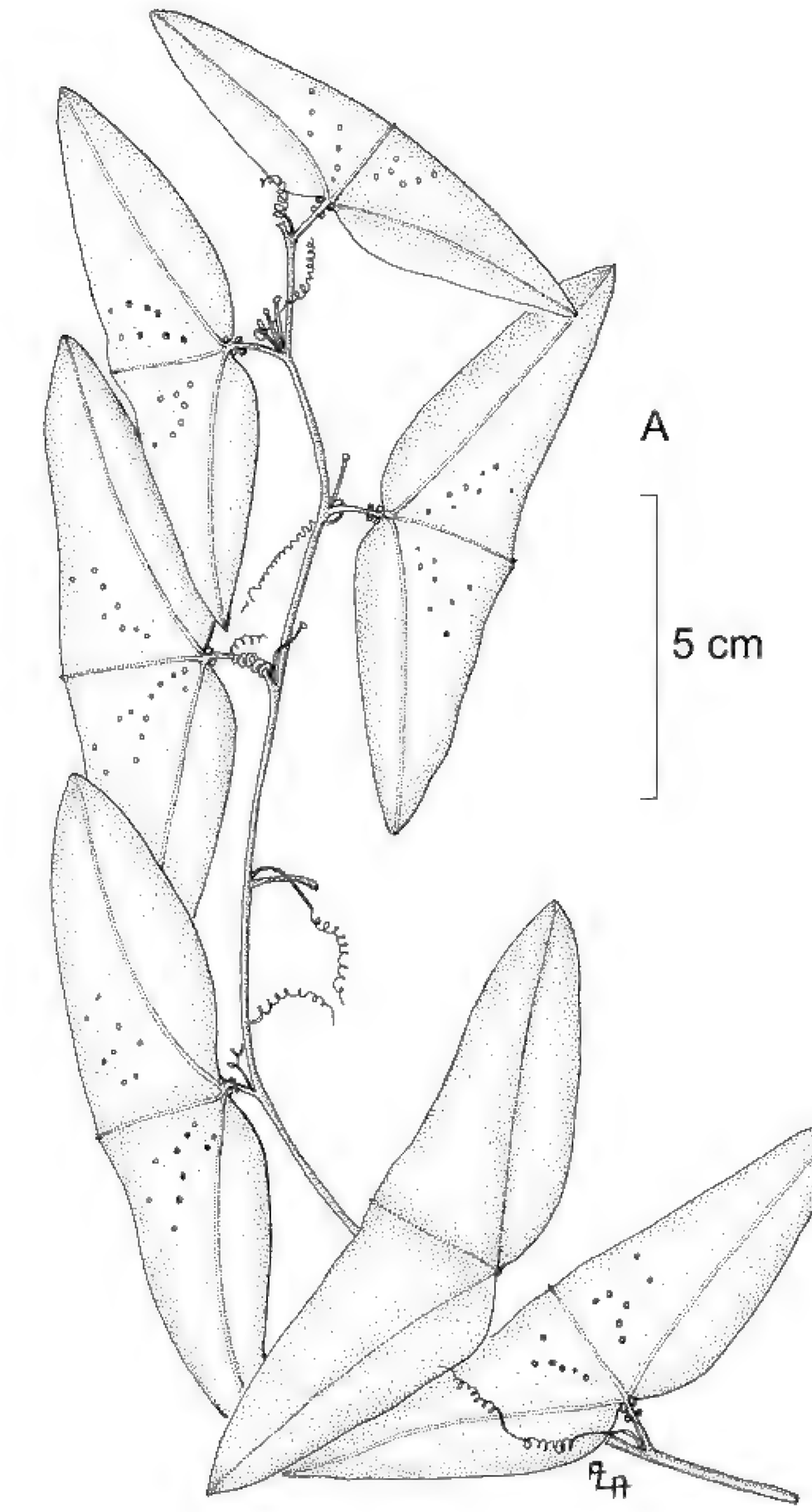
The genus *Passiflora* L. (Passifloraceae) contains more than 575 species of vines and lianas distributed in the New World. Species in the genus can be found from deserts to floodplains to Andean slopes at the limits of puna and páramo (Holm-Nielsen et al., 1988). The species in *Passiflora* subg. *Decaloba* (DC.) Rchb., the second largest subgenus in *Passiflora*, are variable in leaf shape, variegation, the arrangement of extrafloral nectaries on laminas and petioles, and in the size of the flowers. The species described here are placed within the small assemblage of species informally known as the *P. lobbii* Mast. group (Skrabal et al. 2001) within *Passiflora* subg. *Decaloba*. This group consists of ca. 11 taxa (nine species and three subspecies) that are distributed primarily in Peru, with eight species endemic to that country (León & Jørgensen, 2006). The most important diagnostic morphological features of the *P. lobbii* species group are the lamina shape, extrafloral nectaries, corona structure, size and shape of the androgynophore, and indumentum (Skrabal et al., 2001).

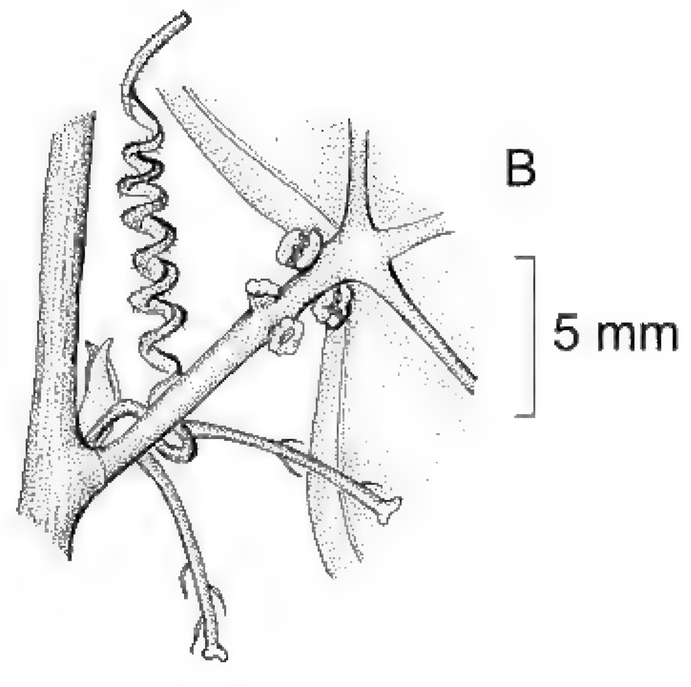
1. Passiflora joergenseniana T. Boza, sp. nov. TYPE: Bolivia. La Paz: Muñecas, Carpa, al lado de la carretera y rio Charazani, 15°12′47″S, 68°49′34″W, 1900 m., 5 May 2005, *A. F. Fuentes & R. Cuevas 7967* (holotype, LPB; isotypes, MO, NY, USZ). Figure 1.

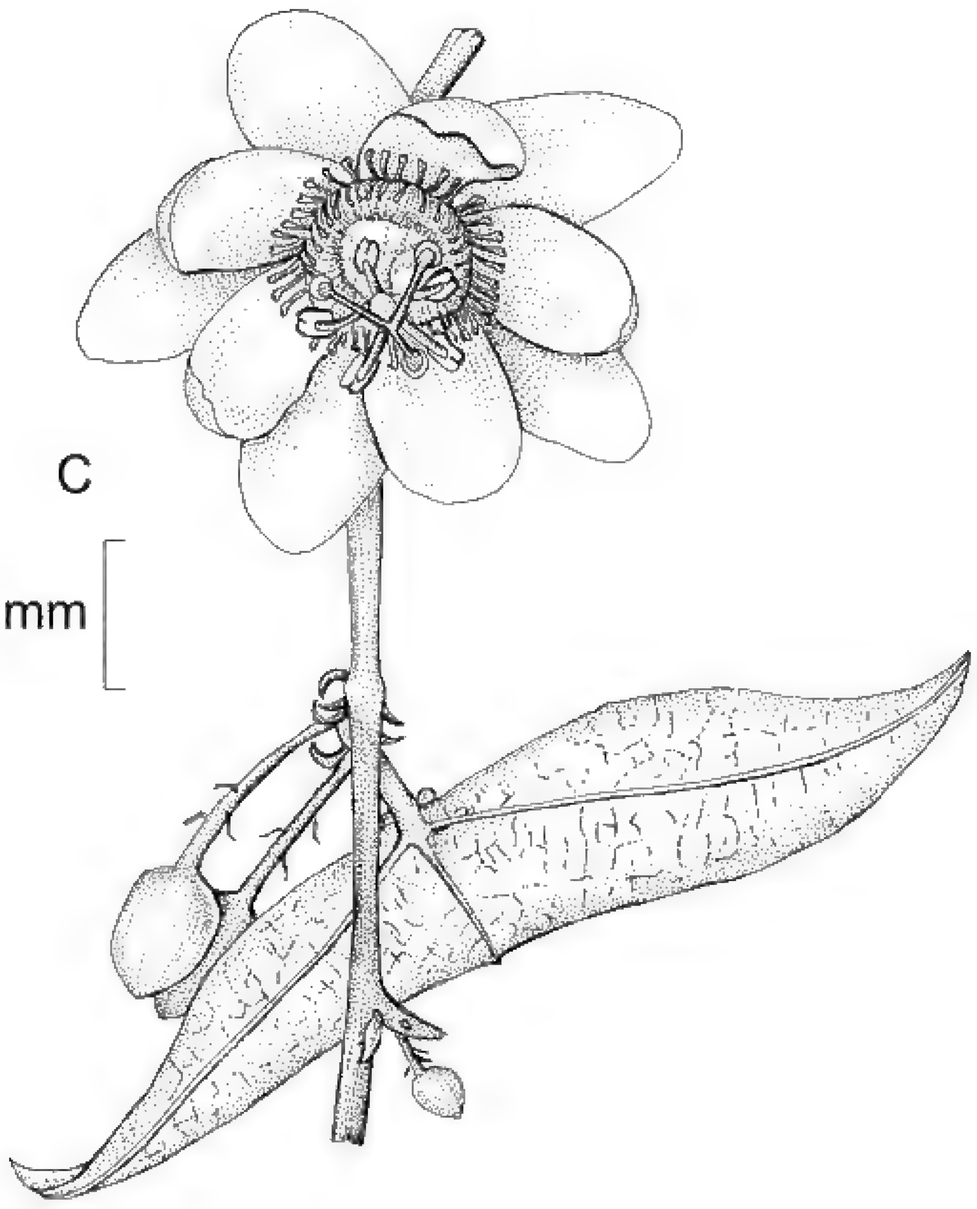
Haec species quoad folia perdepresse obtriangularia *Passiflorae solominii* L. K. Escobar similis, sed ab ea nectariorum laminarium petiolariumque praesentia, sepalis petalisque late ovatis atque filis coronalibus denticulatis longitudine petalorum tertiam partem aequantibus distinguitur.

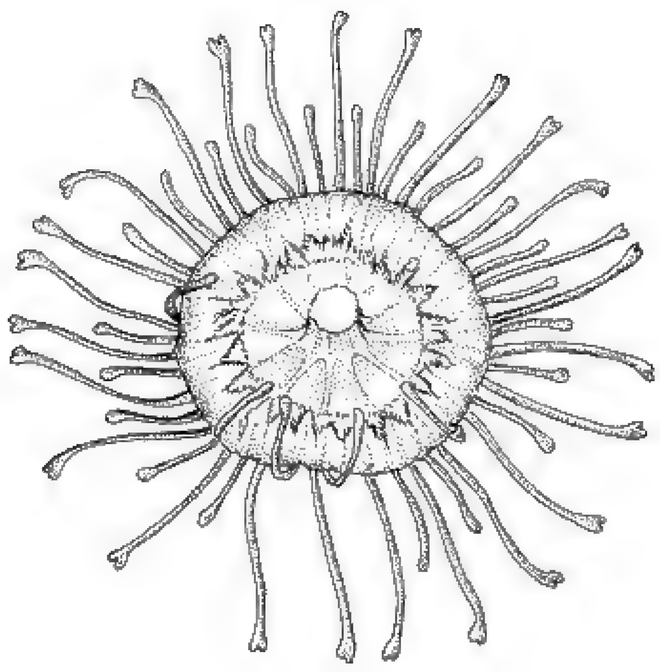
Vine, glabrescent throughout, stems striate; axillary buds covered by two prophylls. Stipules (1.3–) 1.7–2.2(–2.3) × 0.1–0.2 mm, linear to linear triangular, caducous; petioles (9–)9.8–12.1(–14.5) mm with 2 to 4 petiolar nectaries (0.9–)1.2–1.5(–1.8) mm diam., nectaries sessile at the base of the lamina or at the apex of the petiole; lamina 2.5–2.9 × (7.7–) 9.1–10(–12) cm, entire, coriaceous, very shallowly obtriangular, cordate at the base, adaxially dark green, abaxially light green, 2-lobed, lobes acuminate to acute; the angle between lateral lobe veins (119°–) 127°–140°(–148°); with 4 to 18 ocellate glands (0.5–) 0.7–0.9(–1.1) mm diam., distributed randomly between primary veins. Peduncles 9.6–13.7 mm, in pairs, bracts 1.2–1.3 × 0.2–0.3 mm, linear, scattered along the peduncle; floral stipe 1.9–2.3 mm. Flowers ca. 25 mm diam., greenish white or pale yellow-green; sepals 11–11.2 × 5.1–5.3 mm, widely ovate, pale yellow-green, apex rounded; petals 8–9 × 5.0–5.7 mm, widely ovate; pale yellow-green, rounded apex; coronal filaments in 2 series, filaments of outer row 2.8–3 mm long, 1/3 as long as the petals, denticulate in the distal 1/3, purple in proximal part, pale yellow distally; filaments of the inner row 1.5–1.6 mm long, filiform, apex clavate, purple in proximal part, pale yellow distally; operculum 1.5–

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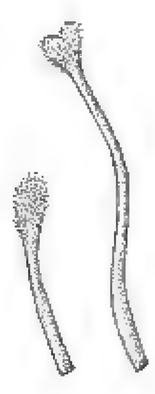


Figure 1. *Passiflora joergenseniana* T. Boza. —A. Sterile habit. —B. Petiole showing four petiolar glands. —C. Flower and section of fertile stem. —D. Corona filaments. —E. Detail of the corona filaments, from left to right, one inner and one outer corona filament. A is drawn from *T. E. Boza E. & Uzquiano 2112* (MO); B, taken from *T. E. Boza E. & Uzquiano 2111* (MO); and C–E, drawn from the type *A. F. Fuentes & R. Cuevas 7967*.

1.6 mm, membranous, plicate; androgynophore ca. 3.9 mm long, green; filaments 2.5–2.6 mm; anthers 1.8–2.2 × 1.2–1.3 mm; ovary ca. 1.9 × 1.2 mm, ellipsoid to fusiform-ellipsoid, glabrous; styles 2.5–3 × 0.1–0.2 mm; stigma 1–1.3 mm diam., capitate. Fruit and seed unknown.

Etymology. The species is named in honor of Peter Møller Jørgensen (1958–), a curator at the MO herbarium, who apart from his contributions to the knowledge of *Passiflora*, has developed a remarkable project studying and protecting the biodiversity in the Madidi region in La Paz, Bolivia, where the new species is endemic.

Distribution and habitat. *Passiflora joergenseniana* is a montane forest species and has been found on the road from Charazani to Camata within the Apolobamba Natural Area of Integrated Management between 1600 and 1900 m.

IUCN Red List category. The new species is assessed as EN or Endangered, based on an area of cccupancy (AOO) estimated at 18 km². Having a small area of distribution, *Passiflora joergenseniana* has an extent of occurrence (EOO) less than 5 km² and exhibits fewer than ten known locations. Populations are considered to suffer extreme fluctuations or to be in continuing decline. This assessment is done according to the IUCN (2001) criteria and categories.

Phenology. Flowers of *Passiflora joergenseniana* have been reported in May.

Passiflora joergenseniana and *P. solomonii* L. K. Escobar, also described from La Paz, Bolivia, are similar in leaf shape, both having very shallowly obtriangular leaves, but can be distinguished by the presence of laminar and petiolar nectaries in the former and their absence in the later. The species can be further differentiated by floral characters. The sepals and petals in *P. joergenseniana* are widely ovate, while in *P. solomonii* the sepals are triangular to triangular-ovate and petals are narrowly elliptic to narrowly ovate. *Passiflora joergenseniana* possesses coronal filaments that are denticulate and 1/3 as long as the petals, while *P. solomonii* has ligulate coronal filaments that are only slightly shorter than petals. Occasionally *P. joergenseniana* resembles *P. exoperculata* Mast. in the leaf shape, but it is very shallowly obtriangular rather than having the depressed obovate leaves of *P. exoperculata*. Further, *P. exoperculata* differs from *P. joergenseniana* by the absence of petiolar nectaries.

Paratypes. BOLIVIA. **La Paz:** Área Nat. de Manejo Integrado Apolobamba, Camata, entre el camino Charazani y Apolo, 15°12′41″S, 068°47′25″W, 25 July 2009, *T. E. Boza E. & Uzquiano 2111* (LPB, MO); Área Nat. de Manejo Integrado Apolobamba, Camata, entre el camino Charazani y Apolo, 15°12′35″S, 068°47′24″W, 25 Jul. 2009, *T. E. Boza E. & Uzquiano 2112* (LPB, MO).

2. Passiflora praemorsa T. Boza, sp nov. TYPE: Peru. Cusco: Prov. La Convención: Dist. de Santa Teresa, común. Yanatile, 13°10′52″S, 72°38′49″W, 2376 m, 27 Dec. 2008, *T. E. Boza E. & P. O. Chambi P. 2024* (holotype, USM; isotypes, HUT, MO, MOL, PRG). Figure 2.

Haec species quoad foliorum magnitudinem formamque *Passiflorae exoperculatae* Mast., *P. lobbii* Mast. subsp. *ayacuchoensi* Skrabal & Weigand, *P. lobbii* subsp. *lobbii*, et *P. sagasteguii* similis, sed ab omnibus petalis linearibus usque anguste triangularibus; ab omnibus praeter *P. lobbii* subsp. *ayacuchoensem* glandularum laminarium praesentia; a *P. exoperculata* filis coronalibus interioribus usque ad 0.8 mm tantum longis; a *P. sagasteguii* floribus viridialbidis vel pallide flavidoviridubus distinguitur.

Vine, sparsely pubescent to glabrescent throughout; stems striate. Stipules (1.7–)1.8–2.1(–2.3) × 0.1–0.3 mm, linear to linear-triangular, caducous, petioles (11–)17.5–21.8(–32) mm with two petiolar nectaries (0.5–)0.9–1.1(–1.2) mm diam., nectaries positioned on basal half of petiole; lamina (2.3–)2.7–3.3(–4.1) × (5.7–)6.9–8.1(–8.9) cm, entire, depressed obovate, cordate at the base, 2(or 3)-lobed, the lateral lobes slightly rounded rarely acuminate to acute, the central lobe, if present, reduced and obtuse or rounded; the angle between the lateral lobe veins (103°–)112°–115°(–125°); with 3 to 9 ocellate glands (0.3–)0.4–0.5(–0.6) mm diam., in lines between primary veins. Peduncles 10.1–12.5 mm, slender, in pairs, bracts 0.7–1.3 × 0.1–0.2 mm, narrowly triangular, scattered along the peduncle. Flowers 17.4–18.7(–20) mm diam., greenish white or pale yellow-green; floral stipe 2.5–5.1(–6.6) mm; sepals (4.3–)6.3–6.9(–8.4) × (1.9–)2.4–2.9(–4) mm, narrowly triangular, sparsely hirsutulous pubescent outside, pale green to white, apex acute; petals (3.7–)5.2–5.7(–6.4) × (0.8–)1.4–1.7(–2.1) mm, linear to narrowly triangular; apex praemorse (ragged), white; coronal filaments in 2 series, filaments of outer row (3.9–)4.4–4.8(–5.2) mm, filiform, purple proximally and white distally; filaments of the inner row (0.5–)0.6–0.7(–0.8) mm, filiform, purple with white apex; operculum (0.8–)0.9–1.1 mm, membranous, laciniate with some clefts 2/3 of the length, purple; androgynophore 2–2.8 mm long, green; filaments (2.1–)2.3–2.6(–2.9) mm; anthers (1.4–)1.8–2(–2.2) × (0.5–)0.7–0.9(–1.2) mm; ovary 0.9–1.4(–1.8) ×

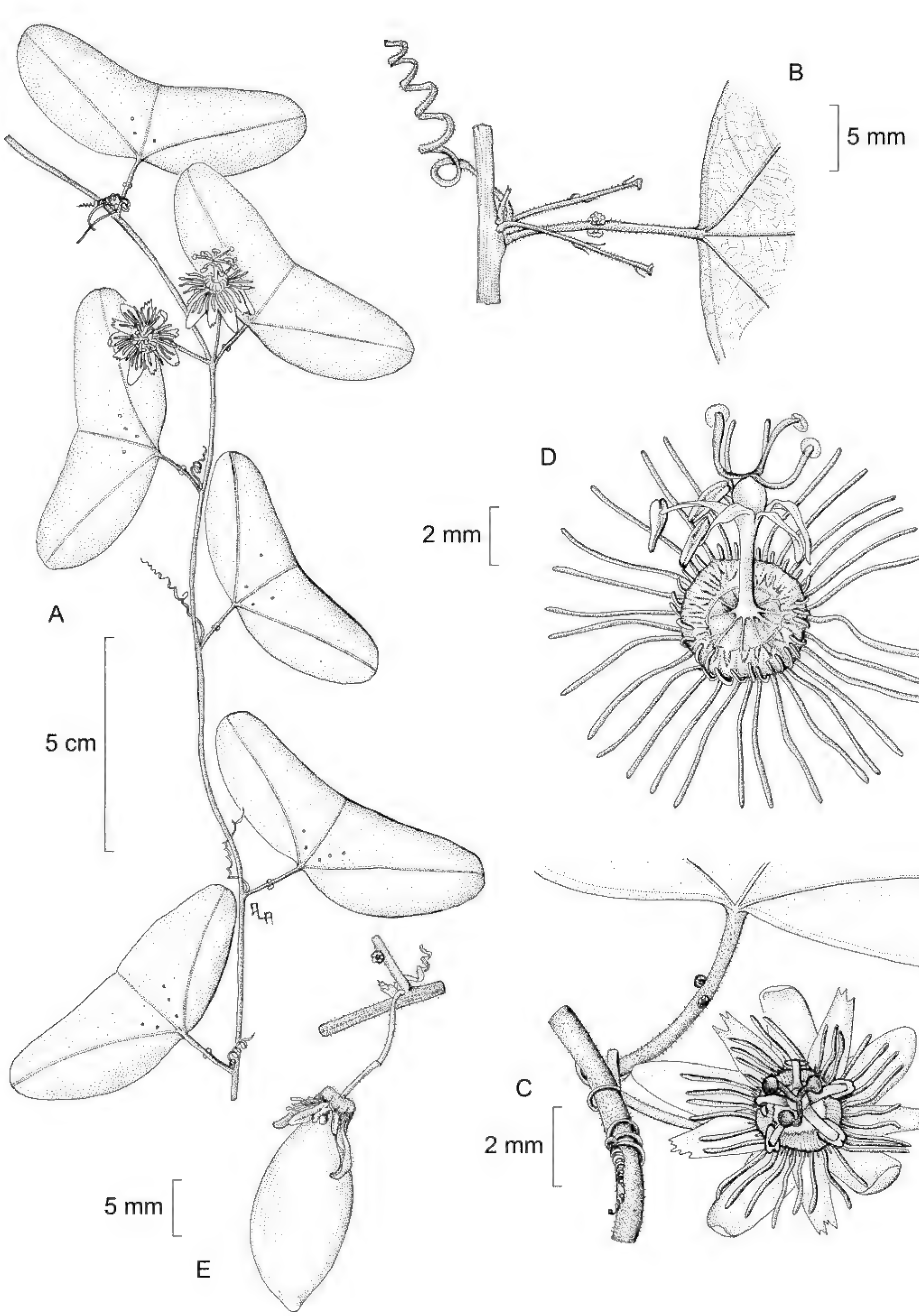


Figure 2. *Passiflora praemorsa* T. Boza. —A. Fertile habit with two flowers evident. —B. Petiole showing two petiolar glands. —C. Flower and section of fertile stem. —D. Detail of the biseriate corona filaments and androgynophore. —E. Fruit. A is drawn from *M. Delanoy 413* (MO); B, taken from *M. Delanoy 402* (MO); C & D, drawn from the type *T. E. Boza E. & P. O. Chambi P. 2024*; and E, from *M. Delanoy 270* (MO).

0.6–0.9(–1.2) mm, ellipsoid, glabrous; styles (1.1–) 2.1–2.2(–2.8) × 0.3–0.4 mm; stigma 0.7–0.9 mm diam., capitate. Fruit 22 × 11 mm, ellipsoid, glabrous, green.

Etymology. The species epithet refers to the praemorse petals that are irregularly truncate, appearing as if bitten off at the apex. This is characteristic of the new species and is seen in only a few other species in *Passiflora* subg. *Decaloba*, but seems to be common in the *P. lobbii* species group, although not in all species. Sometimes an individual plant has an obtuse to rounded petals apices, but some flower may also have praemorse apices, for example, in *P. exoperculata*.

Distribution and habitat. *Passiflora praemorsa* has been found three times in the Yanatile Valley northwest of Machu Picchu in Cusco, Peru, three times in Yanacachi, once between Isquiran and Irupana, and once in Chulumani at the Sud Yungas in La Paz, Bolivia. *Passiflora praemorsa* grows mainly in humid montane forest at mid-elevations between 1700 and 2450 m.

IUCN Red List category. The estimated Extent of Occurrence (EOO) for *Passiflora praemorsa* is 4515.60 km². The mapped area of suitable habitat produces an estimate of the occupied habitat or Area of Occupancy (AOO) of 36 km². This qualifies the species as EN or Endangered, according to IUCN (2001) criteria and categories.

Phenology. The new species has been collected from December to February with flowers and young unripe fruit.

Passiflora praemorsa seems morphologically closest to *P. exoperculata*, *P. lobbii* subsp. *ayacuchoensis* Skrabal & Weigend, *P. lobbii* subsp. *lobbii*, and *P. sagasteguii* Skrabal & Weigend with which the new species shares similar leaf size and shape. The most obvious differences between *P. praemorsa* and these species are the linear to narrowly triangular petal shape and the presence of laminar glands; *P. lobbii* subsp. *ayacuchoensis* does have two to four laminar glands, but possesses narrowly elliptic to narrowly ovate petals. *Passiflora exoperculata* has similar geographical distribution to *P. praemorsa*, but can be differentiated by the length of the inner corona filaments that are longer than 1.1 mm in *P. exoperculata* and smaller than 0.8 mm in *P. praemorsa*. *Passiflora lobbii* subsp. *lobbii* is very similar morphologically to *P. praemorsa* and is endemic to northern Peru, while *P. praemorsa* has been found twice in Cusco, in southern Peru, and in northern Bolivia. *Passiflora praemorsa* differs from *P. sagasteguii* in its distribution and the color of its flowers; *P. praemorsa* has greenish white or pale yellow-green flowers and is found in southern Peru and northern Bolivia, while *P. sagasteguii* usually has pale to dark purplish red flowers and is endemic to northern Peru.

Paratypes. BOLIVIA. **La Paz:** Sud Yungas, rd. from La Florida to Santa Rosa, Yanacachi, 16°21′S, 067°45′W, 17 Jan. 2004, *M. Delanoy 402* (MO); rd. from Chaco to La Florida, Yanacachi, 16°21′S, 067°45′W, 18 Jan. 2004, *M. Delanoy 413* (MO), *M. Delanoy 414* (MO); rd. betw. Isquircan & Irupana, 16°28′S, 067°26′W, 16 Dec. 2003, *M. Delanoy 270* (MO); betw. Las Lomas & San Antonio, Chulumani, 16°21′S, 067°32′W, 09 Dec. 2003, *M. Delanoy 231* (MO).

PERU. **Cusco:** La Convención. Distr. Santa Teresa, Comun. Yanatile, Sect. Toctomayo, 13°10′22″S, 072°38′48″W, 22 Feb. 2004, *T. E. Boza E. 300* (MO); Distr. Santa Teresa, Comun. Yanatile, 13°10′47″S, 072°3′48″W, 27 Dec. 2008, *T. E. Boza E. & Percy O. Chambi P. 2026* (HUT, MO, MOL, PRG, USM).

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A New Species of *Monardella* (Lamiaceae) from Southeastern Oregon and Adjacent Idaho, U.S.A.

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Abstract. *Monardella angustifolia* Elvin, Ertter & Mansfield (Lamiaceae), a new species from southeastern Oregon and adjacent Idaho, is described and illustrated. It occurs on ash tuff outcrops in and near Leslie Gulch in the northern reaches of the Great Basin Desert. The new species is best distinguished by its calyx trichomes, fascicled leaves, and leaf and bract morphology. It is unique in the genus in having very narrow, conduplicate, and often fascicled leaves and being endemic to soils derived from ash tuff. It is most similar morphologically and ecologically to several perennial species of *Monardella* Benth. in the Mojave Desert ca. 900 km to the south. It shares with them a similar habit, pubescence, branching, and bract and glomerule morphologies.

Key words: Ash tuff, Idaho, IUCN Red List, Lamiaceae, Leslie Gulch, *Monardella*, Oregon, U.S.A.

Monardella Benth. (Lamiaceae) is a genus of annuals and perennials that occurs throughout western North America, ranging from northern Mexico to southern Canada with a center of distribution in California. The last complete revision, by C. C. Epling (1925), treated 19 species and an additional 16 infraspecific taxa. There are currently more than 30 species with more than 55 taxa recognized (Sanders et al., 2012; Elvin et al., 2013). More than two thirds of the taxa in this genus have very limited distributions—for example, *M. pringlei* A. Gray (from sand dunes in the vicinity of Colton, San Bernardino County, California) and *M. undulata* Benth. subsp. *arguelloensis* Elvin & A. C. Sanders (from a single population in a 1-km^2 area in Santa Barbara County, California)—and many are of conservation concern. Two *Monardella* taxa have the dubious distinction of being presumed extinct (*M. pringlei*, *M. leucocephala* A. Gray), and another, *M. viminea* Greene, is listed as endangered by both the U.S. Fish and Wildlife Service and the California Department of Fish and Wildlife.

Preparation for the treatment of the genus *Monardella* for the *Flora of Oregon* (in prep.) by the senior author has resulted in the need to publish yet another distinctive taxon of highly limited distribution, known only from collections made subsequent to Epling's 1925 monograph. The *Monardella* in question has been a candidate for further investigation ever since a newly constructed road brought Leslie Gulch to the attention of the scientific community as a botanical hotspot (Ertter & Reveal, 1977; Grimes, 1984). The area is now managed by the Bureau of Land Management as a designated Area of Critical Environment Concern (ACEC), providing core habitat for Asteraceae such as *Senecio ertterae* T. M. Barkley, Boraginaceae such as *Cryptantha propria* (A. Nelson & J. F. Macbr.) Payson and *Phacelia lutea* (Hook. & Arn.) J. T. Howell var. *mackenzieorum* J. W. Grimes & P. L. Packard, Fabaceae such as *Astragalus cusickii* A. Gray var. *sterilis* (Barneby) Barneby and *Trifolium owyheense* Gilkey, Loasaceae such as *Mentzelia packardiae* Glad, Polygonaceae such as *Eriogonum novonudum* M. Peck, and Rosaceae such as *Ivesia rhypara* Ertter & Reveal var. *rhypara*. This concentration of narrowly distributed taxa occurs in correlation with the unique edaphic features of their common substrate, Leslie Gulch tuff, which also provides the spectacular geological formations that make the area a popular recreation site.

Associated with the aforementioned rare plants in Leslie Gulch is a *Monardella* that has long caught the attention of local botanists, including the two junior authors, most notably in its unusually narrow, fascicled leaves. These populations were included within *M. odoratissima* Benth. var. *glauca* (Greene) H. St. John by Cronquist and Reveal (1984), though Reveal (pers. comm., 2013) states that he argued with Cronquist for recognizing the plants as a distinct taxon. When evaluated by the senior author within a genus-wide context, the *Monardella* was determined in fact to be a distinctive new species and is described here.

Taxonomy. The main morphological characters that have been used over time to distinguish between taxa in the genus *Monardella* include plant habit; leaf, bract, and inflorescence morphology; and, to a lesser extent, pubescence (Gray, 1876, 1886; Abrams, 1912a, 1912b, 1951; Epling, 1925, 1939; Jepson, 1925, 1943; Munz, 1935, 1959, 1974; Jokerst, 1993). While these historically used characters can be highly variable (e.g., leaf morphology, stem length) within a single taxon, they can still be helpful for identification, especially when used in tandem. Other characters (e.g., calyx length, bract morphology) can be variable in some taxa but more consistent in others. More recently, we have found pubescence (i.e., leaf, stem, calyx) to be among the most stable of characters to distinguish between species and subspecies in *Monardella* (Elvin & Sanders, 2003, 2009; Sanders et al., 2012; Elvin et al., 2013).

We have noticed that each plant structure (e.g., leaf, stem, calyx, bract) in *Monardella* generally has its own distinct pubescence, and each can have one to several different types of trichomes that are intermixed on these structures. For example, *M. robisonii* Epling has one type of glandular trichomes and two types of nonglandular trichomes all intermixed on the stems. Unfortunately, many of the different types of pubescence are minute, with some as small as 0.01–0.03 mm in length. Trichomes of this size cannot be seen reliably with a standard hand lens, but they can be distinguished with the use of a microscope. As one can imagine, the trichomes do not lend themselves to easy identification in the field, but they do provide for accurate identification.

As noted below, there are differences between the new species and similar and parapatric species in many of the standard, old characters (e.g., leaf morphology, stem length); however, in many instances there is overlap between taxa at the edge of the character ranges (e.g., leaf length). The new species presented below is unequivocally distinct from all other *Monardella* species in pubescence characters (e.g., calyx, stem, bract).

Monardella angustifolia Elvin, Ertter & Mansfield, sp. nov. TYPE: U.S.A. Oregon: Malheur Co., Leslie Gulch watershed, head of Runaway Gulch, exposed volcanic tuff in sagebrush shrub-steppe matrix, 1390 m, 18 July 2013, *B. Ertter 21513* (holotype, OSC; isotypes, ARIZ, ASU, CAS, CIC, F, GH, ID, IDS, K, LA, MEXU, MICH, MO, MSC, NY, RENO, RM, TEX, UBC, UC, UCR, US, UTC, WS, WTU). Figures 1, 2.

Diagnosis. A subshrub similar to *Monardella boydii* A. C. Sanders & Elvin, but differing in having glandular calyx trichomes ca. 0.2 mm (vs. 0.01–0.02 mm) long and leaves that are very narrow, conduplicate, often fascicled, and spreading to reflexed (vs. broader, flat, not fascicled, and ascending).

Subshrub, woody at base, (6)15–30(45) cm tall; primary stems produced yearly, erect; secondary stems sometimes forming at upper nodes of robust plants; stem pubescence retrorse, with two types of stem trichomes, (1) non-glandular, 0.03–0.05 mm, and (2) non-glandular, 0.1–0.2 mm. Leaves often fascicled, spreading to reflexed, (8)10–13 × 1.9–2.5 mm, lorate to very narrowly elliptic, with length-to-width ratios (4)5–7:1, commonly conduplicate exposing the adaxial surface, sessile to subsessile, base acute, cuneate to decurrent, apex widely acute, pale to grayish green, puberulent above and below, sometimes glabrous or nearly so, punctate-glandular. Inflorescence usually solitary, occasionally an open compound cyme (particularly in robust specimens when abundant water and/or nutrients are available during the initial seasonal growth flush and/or when late-season rains prolong the growing season); flowers in terminal glomerules, glomerule on primary stem 16–18 mm wide, glomerules on axillary stems 8–11 mm wide; bracts 7–8(9) × 3–4 mm, less than the calyces, straw to green, purple-tinged, elliptic to narrowly elliptic, apices acute, pubescence sparse, the bracts with one type of trichome, glandular, 0.25–0.3 mm, spreading, bract cilia with one type of trichome, non-glandular, 0.5–1 mm; intraglomerular bractlets narrowly oblong, 4–5 × 0.8 mm, with two types of trichomes, (1) glandular, 0.1–0.2 mm, and occasionally (2) non-glandular, 0.3–0.6 mm; pedicels 1.0–1.5 mm. Flower with the calyx 6–7 mm, green, apex tinged purple; pubescence on the calyx tube sparse with two types of trichomes, (1) glandular, ca. 0.2 mm, and (2) non-glandular, 0.3–0.6 mm (on veins when present); with one type of trichome on calyx teeth, non-glandular, 0.5–1 mm; corolla 13–16 mm, lavender, rapidly deciduous after pollination; corolla



Figure 1. *Monardella angustifolia* Elvin, Ertter & Mansfield. Fertile subshrub in ash tuff outcrop of lower Leslie Gulch, Oregon. Photograph by Jim Reveal, 19 June 2014, of *B. Ertter 21891* (BH, CIC).

tube exserted 3 mm; corolla lobes 4–5 mm, apices obtuse; stigma 18–20 mm, exserted; stamens 15–18 mm, exserted. Fruit a nutlet, brown to dark brown and mottled light and dark brown, oblong, 1.6–1.7 × 0.7–0.8 mm.

Distribution and habitat. *Monardella angustifolia* is endemic to ash tuff outcrops in the Owyhee River watershed of Oregon (Fig. 1), particularly the Leslie Gulch watershed, which is one of its tributaries, and the Succor Creek drainage basin in southeastern Oregon and adjacent Idaho. These areas occur within the northern portion of the Great Basin Desert in the Owyhee Uplands and Canyons ecoregion (U.S. Environmental Protection Agency, 2005), with vegetation mapped and variously classified as sagebrush steppe (U.S. Environmental Protection Agency, 2005), big sagebrush shrubland (Kiilsgaard, 1999), or ash beds (Tobalske, 2002). *Monardella angustifolia* grows almost exclusively on rhyolitic ash tuff outcrops between 850 and 1400 m elevations, often as a local dominant or co-dominant. These relatively barren areas consist of azonal soils, either devoid of or having reduced cover of nearby dominant plant species, typically Asteraceae such as *Artemisia tridentata* Nutt. and *Ericameria nauseosa* (Pall. ex Pursh) G. L. Nesom & G. I. Baird and Poaceae such as *Pseudoroegneria spicata* (Pursh) Á. Löve and *Poa secunda* J. Presl. Associated species on these barren slopes often include the previously mentioned Leslie Gulch ash bed endemics in addition to more widely distributed taxa, for example, Asteraceae such as *Eriophyllum lanatum* (Pursh), *Gutierrezia sarothrae* (Pursh) Britton & Rusby, and *Stephanomeria tenuifolia* H. M. Hall; Boraginaceae such as *Phacelia hastata* Douglas ex Lehm.; Brassicaceae such as *Physaria chambersii* Rollins and *Stanleya pinnata* (Pursh) Britton; Caryophyllaceae such as *Minuartia nuttallii* (Pax) Briq. var. *nuttallii*; Fabaceae such as *Lathyrus pauciflorus* Fernald var. *pauciflorus*; Linaceae such as *Linum lewisii* Pursh.; Loasaceae such as *Mentzelia albicaulis* (Douglas ex Hook.) Douglas ex Torr. & A. Gray; Orobanchaceae such as *Castilleja angustifolia* (Nutt.) G. Don; Rosaceae such as *Purshia tridentata* (Pursh) DC.; and Poaceae such as *Achnatherum hymenoides* (Roem. & Schult.) Barkworth.

Peak flowering period is June and July, with onset sometimes by late May. Summer rains can extend the flowering season or else produce a second late-season flowering period as late as early October. This monsoonal phenology is very unusual in this region, where most species are adapted to a summer-dry

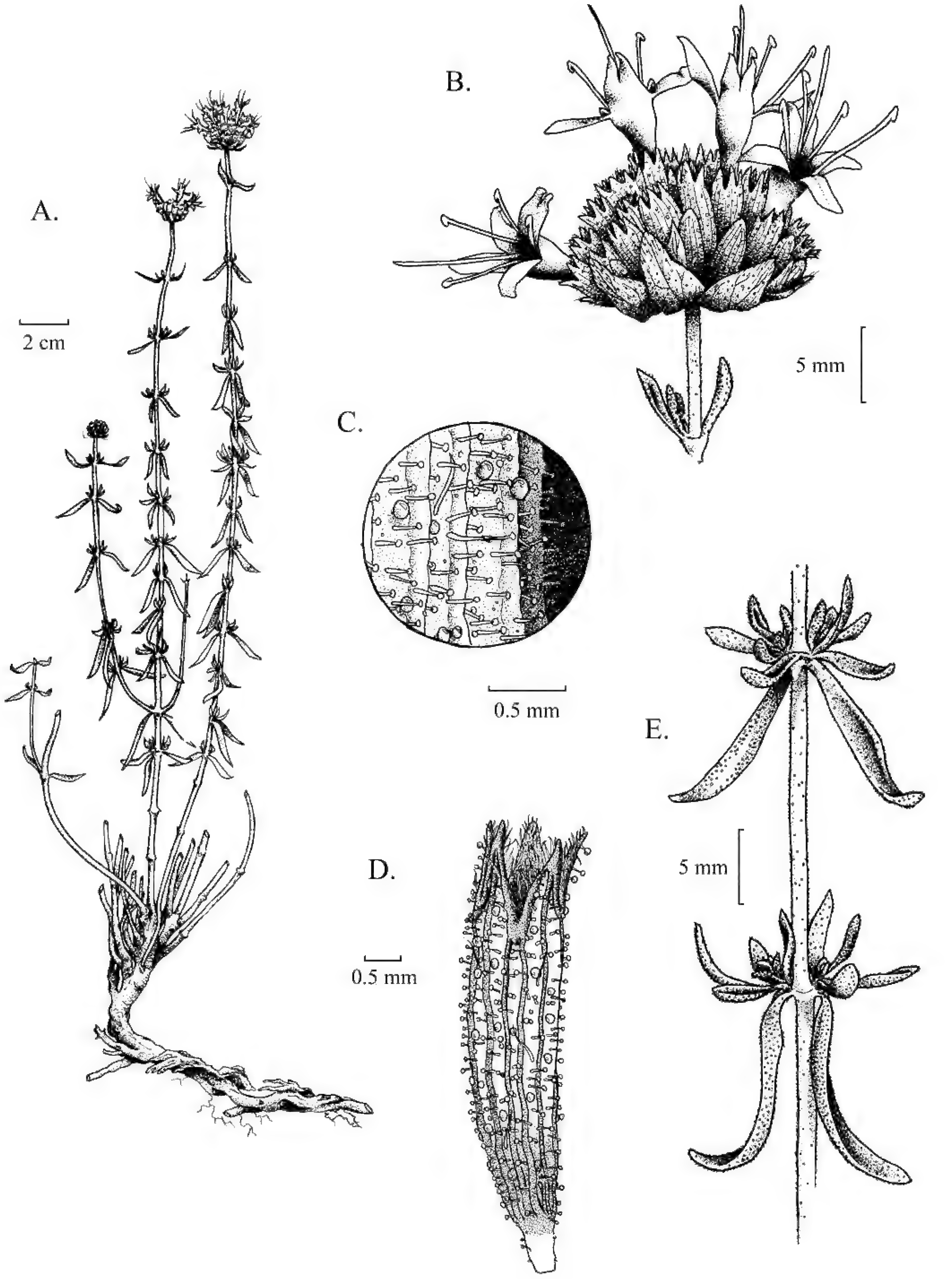


Figure 2. *Monardella angustifolia* Elvin, Ertter & Mansfield. —A. Fertile plant habit. —B. Glomerule. —C. Calyx pubescence close-up. —D. Calyx. —E. Stem segment, with fascicled leaves at two nodes. Drawn by Alexa DiNicola from paratypes *D. Mansfield 13–020, 13–216,* and *13–220* (all at CIC).

climate. *Monardella angustifolia* is sometimes nearly the only plant in bloom at a site, attracting large numbers of bumblebees, other bees, and butterflies (Ertter, pers. obs., 2013).

Three separate metapopulations of *Monardella angustifolia* are currently known, the largest known from the canyon of Leslie Gulch and several of its associated tributaries, for example, Dago, Juniper,

and Runaway gulches. Geologically equivalent habitat occurs discontinuously along a 9.7-km distance within the Leslie Gulch watershed, from about 850 to 1400 m elevation. The second metapopulation spans the Oregon-Idaho border on the ridge south (and possibly north) of upper Succor Creek, 22 km southeast of Leslie Gulch, extending from 1300 to 1400 m in elevation. Plants in this metapopulation occur primarily on discontinuous outcrops geologically similar to those in Leslie Gulch. The third and most isolated metapopulation occurs 41 km southwest of Leslie Gulch, in the Chalk Basin area on the Owyhee River near Lambert Rocks and the mouth of Bogus Creek, at about 1000-m elevation. The habitat is comparable to Leslie Gulch, with similar regional endemics, for example, Boraginaceae such as *Cryptantha propria* and Polygonaceae such as *Eriogonum novonudum*. Most *Monardella* collections from this third site were made early in the season and are sterile; however, their pubescence unequivocally indicates that they are *M. angustifolia*.

IUCN Red List category. *Monardella angustifolia* has a restricted distribution that contains three disjunct metapopulations within 55 km of each other. The new species has an area of occupancy (AOO) of ca. 8 km^2 (1990 acres), with minimum concave polygons, which supports an assessment of EN or Endangered (EN B1a). The extent of occurrence (EOO) is ca. 629 km^2 (155,540 acres). A portion of one of the metapopulations (Leslie Gulch) is owned by the U.S. Department of Interior Bureau of Land Management and occurs mostly within an area classified as an ACEC because of the high concentration of ash tuff substrate–dependent rare plant species. Given the uncertainty regarding climate change, the new species' extremely limited distribution, and the fragmentation of the occurrences, *M. angustifolia* is assessed here as Critically Endangered (CR B1ab[i,ii,v]) based on minimum concave polygons, according to IUCN (2001). *Monardella angustifolia* seeds have been collected from two occurrences as part of the Seeds of Success program (U.S. Department of the Interior, Bureau of Land Management, n.d.) and were identified as either *M. odoratissima* or *M. glauca* Greene.

Etymology. The specific epithet refers to the exceptionally narrow leaves. While most *Monardella* taxa have elliptic, lanceolate to ovate leaves, *M. angustifolia* has distinctive lorate to very narrowly elliptic leaves that are among the narrowest seen for any *Monardella*. Additionally, the leaf blades are usually conduplicate, giving them an even narrower appearance.

Discussion. Specimens of *Monardella angustifolia* have previously been included, if only by default, within *M. odoratissima* var. *glauca* (Cronquist & Reveal, 1984), which is much more common throughout southeastern Oregon and southwestern Idaho, including the Owyhee Uplands. *Monardella odoratissima* subsp. *glauca* (Greene) Epling mostly grows at higher elevations and/or in less xeric habitats than *M. angustifolia* and sometimes extends into the lower conifer zone and into the upper Owyhee River drainage on river gravels. Morphologically, *M. angustifolia* can be distinguished from *M. odoratissima* subsp. *glauca* and other *Monardella* taxa of the Pacific Northwest not only by its often fascicled, narrow, spreading, and conduplicate leaves (Fig. 2E) but also by the presence of spreading glandular trichomes ca. 0.2 mm long on the calyces (Fig. 2C, 2D). Additionally, many *M. angustifolia* specimens have narrowly oblong and pubescent bractlets within the glomerule. These "intraglomerular bractlets" also have the spreading, 0.2-mm glandular trichomes. They may be unique to this new species within *Monardella*, and not just a distinction between *M. angustifolia* and *M. odoratissima* s.l.

Monardella angustifolia appears rather to be most closely related to a group of perennial *Monardella* taxa in the Mojave Desert ca. 900 km to the south (e.g., *M. eplingii* Elvin, A. C. Sanders & J. L. Anderson, *M. boydii*, *M. mojavensis* Elvin & A. C. Sanders, and *M. eremicola* A. C. Sanders & Elvin). These taxa are all similar in general habit, vestiture, pubescence, inflorescence structure, and habitat affinities. They generally share smaller glomerules less than 20 mm, shorter calyces less than 8 mm, and smaller leaves and bracts than seen elsewhere in the genus. Either *M. angustifolia* may be most closely related to *M. eplingii*, or the two species may be the products of convergent evolution. Both are the only known *Monardella* species that grow almost exclusively on volcanic tuff or ash soils, and both occur in association with a number of species common to desert environs, specifically Asteraceae such as *Artemisia tridentata* and *Gutierrezia sarothrae*, Brassicaceae such as *Stanleya pinnata*, Rosaceae such as *Purshia tridentata*, and Poaceae such as *Poa secunda*. *Monardella angustifolia* is distinguished from *M. eplingii* by its lack of glandular trichomes and lack of long, spreading non-glandular trichomes 0.3–0.5 mm on the stem (both present on *M. eplingii*); longer calyces (6–7 mm vs. 5–6 mm in *M. eplingii*); larger glomerules (16–18 mm vs. 7–12 mm); and smaller leaves ([8]10–13 mm vs. 12–20 mm).

The paratypes listed below are organized by the three known metapopulations, with Succor Creek spanning the Idaho/Oregon border. Not included among the cited paratypes are two *Monardella angustifolia* specimens (*P. Train s.n.* [OSC-35395] and *P. Train 14238* [NY]) purportedly collected from "Stein's Mountain [Steens Mountain], Harney County, Oregon." Neither plants nor appropriate habitat are known from Steens Mountain for *M. angustifolia*, in spite of extensive fieldwork undertaken by one of us in preparation for a flora of the area (Mansfield, 2000). We suspect Train erroneously labeled some collections he made in the Leslie Gulch area, including *M. angustifolia*, as collected from Steens Mountain with a number of his other collections.

Paratypes. U.S.A. **Idaho:** Owyhee Co., Succor Creek, *A. DiNicola 2013-15*, *2013-22*, *2013-25*, *2013-27* (all four at CIC), *D. Mansfield 13–220* (CIC, OSC, NDG, VFWO), *L. Polito 24* (CIC), *A. Truksa 46* (CIC). **Oregon:** Malheur Co., Succor Creek, 12 Sep. 2011, *Garbowski s.n.* (CIC), *R. Hamre 37* (CIC), *A. Irangabiye 52* (CIC), *D. Mansfield 13–216* (BBLM, BRIT, BRY, CAS, CIC, OBI, OSC, RSA, SBBG, SD, V), *L. Polito 23* (CIC); Leslie Gulch, *A. DeBolt 832* (CIC), *B. Ertter 14396* (CIC, MO, OSC, UC), *21674* (CIC), *21676* (CIC), *21891* (BH, CIC), *E. Joyal 923* (OSC); *T. Kaye 1025* (CIC, OSC), *D. Mansfield 13–020* (CIC), *P. L. Packard 73–288* (CIC, NY, OSC, UTC), 12 Aug. 2010, *D. Thomas s.n.*, (CIC), *G. Wigglesworth GW40* (CIC); Chalk Basin on Owyhee River, *D. Mansfield 02–225* (CIC), *02–250* (CIC), *P. L. Packard 79-51* (CIC), *79-73* (CIC).

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Lectotipificación de *Ruta montana* (Rutaceae)

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Resumen. Se tipifica el nombre de *Ruta graveolens* L. var. *montana* L. (Rutaceae), basiónimo de *R. montana* (L.) L., a partir de un material conservado en el herbario de Burser (UPS-BURSER).

Abstract. The name *Ruta graveolens* L. var. *montana* L. (Rutaceae), basionym of *R. montana* (L.) L., is lectotypified from material preserved in the Herbarium Burser (UPS-BURSER).

Key words: *Ruta*, Rutaceae.

Linnaeus (1753: 383) describió dentro de *Ruta graveolens* L. (Rutaceae) la variedad *montana*, taxon que posteriormente sería considerado a nivel específico por el propio Linnaeus (1756: 52), categoría taxonómica con la que suele reconocerse en la actualidad. Esta especie se distribuye por la Península Ibérica, Mallorca, sur de Francia, norte de Italia, sur de la Península Balcánica, Anatolia y Magreb (Townsend, 1968; Pignatti, 1982; Bolòs & Vigo, 1990; Bennig, 2007). Se trata de una especie perenne de base leñosa presente en claros y orlas de bosques, matorrales, pastos secos, pedregales, roquedos soleados, cauces fluviales y un conjunto de hábitats más o menos degradados, como bordes de caminos, taludes y campos de cultivos abandonados. *Ruta montana* (L.) L. es una planta utilizada desde muy antiguo por sus propiedades medicinales relacionadas con sus efectos antibacterianos, bacteriostáticos y antimicóticos (Font Quer, 1961).

Esta especie se caracteriza por sus hojas con segmentos filiformes, de aproximadamente 1 mm de anchura y flores amarillas con pétalos caracterizados por tener el borde entero o ligeramente ondulado pero nunca dividido. Resulta morfológicamente muy próxima a *Ruta graveolens* como ya puso de manifiesto el propio Linnaeus "structura tamen omni ita similis Rutae graveolenti, ut differentia non detur, tamen distinctissima & constantissima" (1756: 52), con la que a menudo ha sido confundida.

Desde el punto de vista nomenclatural, el nombre de *Ruta montana* no ha sido hasta la fecha tipificado. Tras la búsqueda de material original para designar su correspondiente tipo, existe en el herbario LINN un pliego con material de Linnaeus (Herb. Linn. No. 537.2 [LINN]) (imagen disponible en <http://linnean-online.org/5858/>). Este pliego contiene un fragmento en buen estado de conservación, muestra hojas y flores, y permite una correcta interpretación del uso tradicional de este nombre.

A parte de este ejemplar, también constituye material original el pliego de Joachim Burser (Herb. Burser XIX: 37 [UPS-BURSER]) (Fig. 1) y los excelentes iconos de Mattioli (1586: 495) y Clusius (1601: 136), "*Ruta montana*". El pliego de Burser contiene dos fragmentos en buen estado de conservación, con flores y frutos, y una etiqueta en la que aparece escrito "*Ruta sylvestris minor* Bauh.", texto que coincide con lo publicado en el protólogo de Linnaeus, además en la etiqueta también se lee: "Monspelii sponti 37". Como indica Jarvis (2007), el herbario de Burser está organizado de acuerdo con la obra de su maestro Bauhin (1623), y por lo tanto esta obra y el mencionado herbario están vinculados. Este herbario estaba depositado en Uppsala cuando fue utilizado por Linnaeus para la interpretación de los nombres que aparecen en la obra de Bauhin, por lo que el pliego de Burser XIX: 37 (UPS-BURSER) corresponde a un material original sobre el que poder tipificar el nombre de Linnaeus. Este pliego resulta más completo que el pliego Herb. Linn. No. 537.2 (LINN) y además de flores tiene frutos.

Por otro lado, existen en el herbario S-LINN dos pliegos que contienen en ambos casos un único fragmento, ambos pertenecientes a esta especie (Herb. Linn. No. 167.9 y 167.11 [S-LINN]), pero no constituyen material original de Linnaeus. El pliego Herb. Linn. No. 167.9 (S-LINN) (imagen disponible en <http://linnaeus.nrm.se/botany/fbo/r/ruta/rutagra1.html.en>) contiene una etiqueta en la que se lee: "Ruta foliis bipinnatis linearibus, floribus spicatis, secundis, spicis divaricato corymbosis. Lisbon in Se[pulcreto] Protestantium legi [Löefling ? scripsit]", y lleva anotado sobre la cartulina y en el anverso, lo siguiente: "*Ruta graveolens* var. *montana* sp. pl. 383 Ruta Ruta von Linné scripsit montana", y en el reverso: "Herb. Alstroemerii a Linné P." El pliego



Figura 1. Lectótipo de *Ruta graveolens* L. var. *montana* L., Sp. Pl. 1: 383. 1753. (Herb. Burser XIX: 37 [UPS-BURSER]), el lectótipo es el fragmento situado en la parte izquierda del pliego.

Herb. Linn. No. 167.11 (S-LINN) (imagen disponible en: <http://linnaeus.nrm.se/botany/fbo/r/ruta/rutagra2.html.en>) lleva anotado sobre la cartulina, en el anverso: *R. montana*, y en el reverso: "Herb. Alstroemerii *Ruta montana Ruta chalepensis graveolens* Dahl a Linné P." Como indica Jarvis (2007: 189, 200) tanto Clas Alströmer como Anders Dahl recibieron pliegos de Linnaeus que posteriormente

han pasado a formar parte de la colección linneana en el Museo de Historia Natural de Stokolmo en Suecia (S), pero en ambos casos son materiales posteriores a la publicación del Species Plantarum en 1753.

En conclusión, aunque el tipo de este nombre puede ser designado a partir del pliego de Burser así como del ejemplar conservado en Herb. Linn. No. 537.2 (LINN) y de los iconos de Mattioli (1586) y Clusius (1601), se considera como el mejor candidato a lectótipo del nombre de Linnaeus *Ruta graveolens* var. *montana* el pliego conservado en UPS-BURSER.

Ruta graveolens L. var. **montana** L., Sp. Pl. 1: 383. 1753. *Ruta montana* (L.) L., Amoen. Acad. 3: 52. 1756. TIPO: [Egipto y Mauritania] "Habitat in Europe australis, Alexandriae, Mauritaniae sterilibus," Herb. Burser XIX: 37 (lectótipo, aquí designado, UPS-BURSER [fragmento situado en la mitad izquierda del pliego]). Figura 1.

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A New Species of *Vachellia* (Fabaceae, Mimosoideae) from the Dominican Republic

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Abstract. *Vachellia azuana* R. G. García, Clase, Ebinger & Seigler (Fabaceae: Mimosoideae), a new species from the Azua Province, Dominican Republic, is described, illustrated, and compared to related species from the Dominican Republic and Haiti. This previously undescribed species is most similar to, but distinct from, *V. barahonensis* (Urb. & Ekman) Seigler & Ebinger, also known from Azua Province.

Key words: Dominican Republic, Fabaceae, IUCN Red List, *Vachellia*.

During the course of fieldwork on the Azua Peninsula, Dominican Republic, shrubs of a previously undescribed species were collected. Most closely related to three other species of the genus *Vachellia* Wight & Arn. from the Dominican Republic—*V. barahonensis* (Urb. & Ekman) Seigler & Ebinger, *V. cucuyo* (Barneby & Zanoni) Seigler & Ebinger, and *V. oviedoensis* (R. G. García & M. M. Mejía) Seigler & Ebinger—and one species from Haiti, *V. caurina* (Barneby & Zanoni) Seigler & Ebinger, this new species occurs in the arid southwestern part of the Dominican Republic (Barneby & Zanoni, 1989; García & Mejía, 2000; Clarke et al., 2009). This taxon seems most closely related to *V. barahonensis* but is clearly distinctive and is here proposed as a new species.

Vachellia azuana R. G. García, Clase, Ebinger, & Seigler, sp. nov. TYPE: Dominican Republic. Azua: Lomo La Vigia, open thorn-shrub vegetation, ground layer dominated by grasses, 8 km S of Azua, 18.39374N, 70.71172W, 29 May 2006, *D. Seigler, J. Miller, C. Riggins, F. Axelrod & T. Clase 14504* (holotype, JBSD; isotypes, EIU, ILL, MO). Figure 1.

Haec species *Vachelliae barahonensi* (Urb. & Ekman) Seigler & Ebinger affinis, sed ab ea foliolis obovatis vel oblanceolatis in 2 ad 6 paribus per pinnam et fructibus (leguminibus) valde complanatis differt.

Shrub to 4 m tall; bark light brown, smooth, older branches usually bearing clusters of fusiform, straight stipular spines to 100 mm. clustered on short shoots; twigs dark gray to dark reddish brown, terete, not flexuous, glabrous; short shoots commonly present above the stipular spines, 1–2 mm, covered with acuminate stipules and old leaf bases; prickles absent. Leaves alternate, also clustered on short shoots, 0.7–7 mm; stipular spines light reddish brown, becoming gray with age, symmetrical, terete, straight, woody, 1–10 × 0.3–0.7 mm near the base, glabrous, woody; sometimes becoming enlarged and similar to the spines found on short shoots of older branches; petiole adaxially grooved, 0.7–7 mm, glabrous; petiolar gland solitary, located just below the pinna pair, columnar, 0.3–0.8 mm, apex circular, 0.3–0.7 mm across, depressed, glabrous; rachis absent; pinnae 1 pair per leaf, 3–21 mm, rarely with a small gland between leaflet pairs; paraphyllidia absent; petiolules 1–5 mm; leaflets 2 to 6 pairs per pinna, opposite, 1.5–4 mm between leaflets, obovate to oblanceolate, 3.7–12.5 × 1.5–6.5 mm, glabrous, lateral veins not obvious, 1 vein from the base, base oblique, margins not ciliate, apex obtuse, sometime emarginate, midvein central. Inflorescence a densely flowered, globose to slightly subglobose head, 4–7 mm across, solitary (2) from the short shoots; peduncles 8–30 × 0.2–0.4 mm, glabrous; receptacle globose; involucre 4- to 5-lobed, located at the base to 2 mm below the head, persistent; floral bracts spatulate, 0.4–0.8 mm, sparsely puberulent, more or less persistent. Flowers sessile, yellow; calyx 5-lobed,

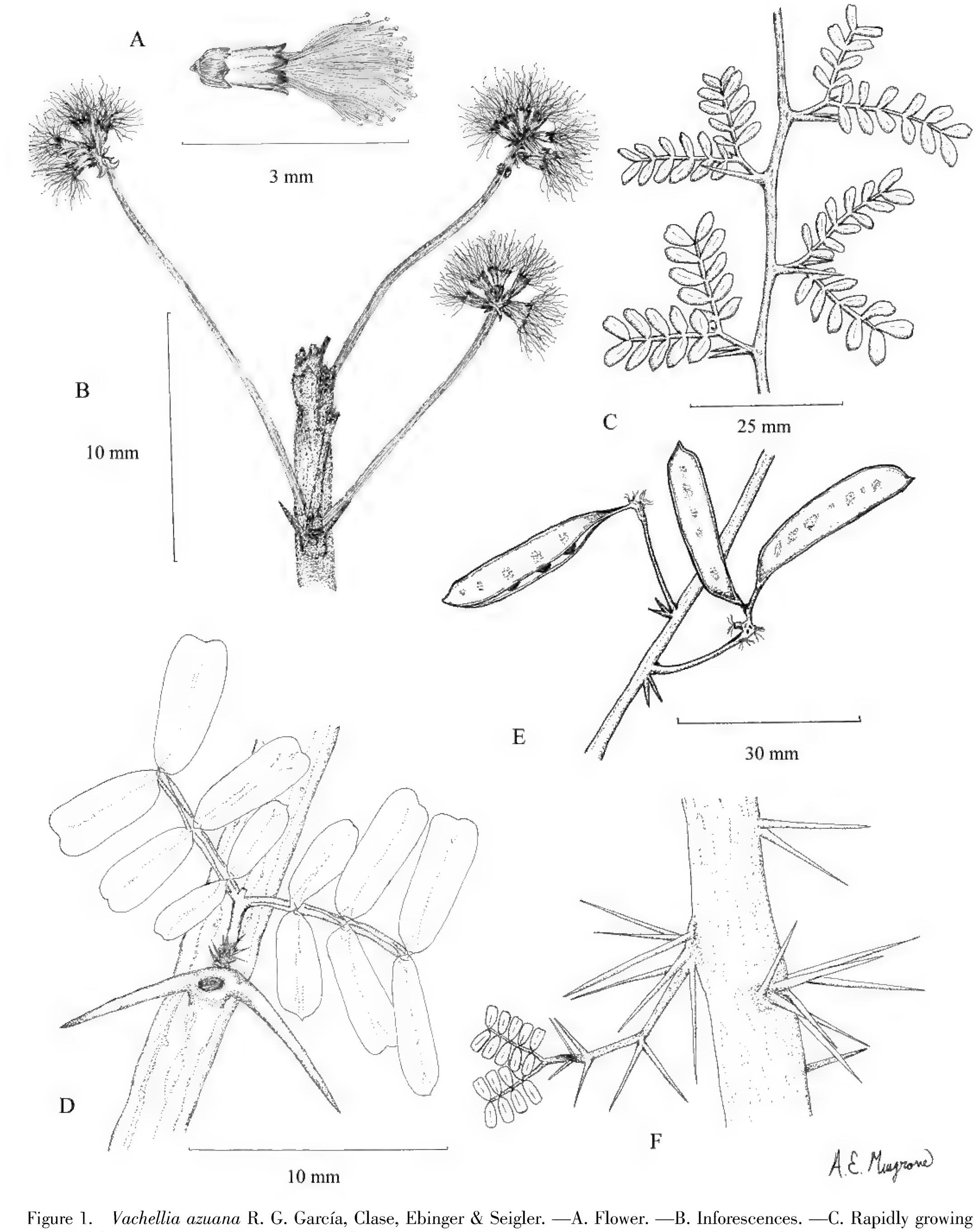


Figure 1. *Vachellia azuana* R. G. García, Clase, Ebinger & Seigler. —A. Flower. —B. Inforescences. —C. Rapidly growing stem with leaves. —D. Leaf from short spur branch. —E. Fruits. —F. Fusiform spines. A–D from *Seigler et al. 14504* (JBSD); E, from *Clase & Reynoso 5883* (JBSD); F, from a plant in the JBSD Botanic Garden.

0.4–0.8 mm, glabrous; corolla 5-lobed, 1.2–1.8 mm, glabrous, lobes one-quarter the corolla length; stamens 25 to 35; stamen filaments 1.8–2.8 mm, distinct; anther glands absent; ovary glabrous, stipe to 0.4 mm. Legumes dark reddish brown, straight, flattened, not constricted between the seeds, linear, 35–65 × 5–7 mm, coriaceous, reticulately striated, glabrous and dull, eglandular, dehiscent along both sutures; stipe 3–6 mm long; apex acute; seeds uniseriate, not surrounded by pulp, light to dark

brown, ellipsoid, flattened, 3.5–4.5 × 3.0–3.8 mm, smooth; pleurogram oval, 1.5–2.2 mm across, 5–8. Chromosome number not determined.

Phenology. *Vachellia azuana* has been observed in flower from May to July.

Habitat and distribution. The new species can be found in open canopy, dry thorn-scrub vegetation 3–4 m tall in the Azua Peninsula, Azua Province, Dominican Republic. This species occurs at low and intermediate elevations (1–400 m) where there is a pronounced dry season, and the thin alkaline soil barely covers the limestone bedrock. Associated taxa include *Senegalia skleroxyla* (Tussac) Seigler & Ebinger, *Croton* L. spp., *Caesalpinia* L. spp., and *Leptochloopsis virgata* (Poir.) H. O. Yates.

IUCN Red List category. *Vachellia azuana* is apparently rare as it is found only in a small area of the Azua Peninsula of the Dominican Republic. We have seen only one population and one additional collection and plants in the Jardín Botánico Nacional, suggesting that this species is probably Endangered (EN; IUCN, 2001). However, at this time we must assess the new species as Data Deficient (DD).

Paratypes. DOMINICAN REPUBLIC. **Azua:** Loma La Vigía, 800 m al Sur de Monte Río en la carretera hacia La Salinas, 360 m, 20 June 2001, *R. García, T. Clase & L. Monegro 7415-A* (ILL, JBSD, MO); Lomo La Vigía, 8 km S of Azua, 29 May 2006, *D. Seigler, J. Miller, C. Riggins, F. Axelrod & T. Clase 14505* (EIU, ILL, JBSD, MO, NY); Lomo La Vigía, 8 km S of Azua, 29 May 2006, *D. Seigler, J. Miller, C. Riggins, F. Axelrod & T. Clase 14506* (EIU, ILL, JBSD, MO). **Distrito Nacional:** Jardín Botánico Nacional, área de Plantas Endémicas, 3 May 2010, *T. Clase & L. Reynoso 5883* (ILL, JBSD).

KEY TO THE *VACHELLIA* SPECIES FROM THE DOMINICAN REPUBLIC AND HAITI THAT HAVE ONE OR TWO PAIRS OF PINNAE

1a. Leaves with 2 or more pairs of pinnae (some with only one pair) . . . . *V. cucuyo* (Barneby & Zanoni) Seigler & Ebinger

1b. Leaves consistently with 1 pair of pinnae.

2a. Sprawling shrub to 1 m tall; leaflets finely puberulent (Haiti) . . . . . *V. caurina* (Barneby & Zanoni) Seigler & Ebinger

2b. Erect shrub or small tree; leaflets glabrous or nearly so.

3a. Leaflets mostly one (less commonly 2) pair per pinna . . . . . *V. oviedoensis* (R. G. García & M. M. Mejía) Seigler & Ebinger

3b. Leaflets consistently 2 or more pairs per pinna.

4a. Leaflets oblong; many pinnae with more than 6 pairs of leaflets; legumes elliptic in cross section ... *V. barahonensis* (Urb. & Ekman) Seigler & Ebinger

4b. Leaflets obovate to oblanceolate; pinnae with 2 to 6 pairs of leaflets per pinna; legumes flattened . . . . . *V. azuana* R. G. García, Clase, Ebinger & Seigler

Acknowledgments. We wish to thank Gordon Tucker of Eastern Illinois University for helping to prepare the Latin description and a critical review of the manuscript; Kanchi Gandhi for advice concerning questions of nomenclature; Frank Axelrod, Joe T. Miller, and Chance W. Riggins for helping with the fieldwork, and Francisco Jiménez, Curator of the Jardin Botánico Nacional Herbarium, Santo Domingo, Dominican Republic. We also thank Alexa E. Musgrove for the preparation of drawings. We wish to acknowledge support by the National Science Foundation (NSF BSR 82–15274 and NSF-PCM 82–17114, NSF 04–15803), and the University of Illinois Research Board (1994, 2001).

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García, R. & M. Mejía. 2000. Una especie de *Acacia* (Mimosaceae) nueva para la ciencia. Moscosoa 11: 7–10.

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Two New Species of *Monopyle* (Gesneriaceae) from Panama

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Abstract. Two new species of *Monopyle* Moritz ex Benth. (Gesneriaceae) are described from central Panama near the Caribbean coast in the Panama Copper Concession (Conseción Minera Panamá S. A.). The new species are endemic to Panama, are poorly represented in herbaria, and are differentiated from other *Monopyle* by a suite of characters. *Monopyle aurea* Keene & J. L. Clark has yellow flowers with a distinct maroon osmophore and red fleshy fruits. *Monopyle longicarpa* J. L. Clark & Keene has a villous golden indument on all vegetative surfaces and elongate linear fruits. Both species are differentiated from other congeners by the presence of small glandular trichomes along the margins of the corolla lobes.

Resumen. Se describen dos especies nuevas de *Monopyle* Moritz ex Benth. (Gesneriaceae) de la Región Central de Panamá, cerca a la costa Caribe, en la Concesión Minera Panamá S. A. Las especies nuevas son endémicas de Panamá, son escasamente representadas en colecciones de herbario, y se diferencian de otras especies de *Monopyle* por una serie de características. *Monopyle aurea* Keene & J. L. Clark tiene flores amarillas con un osmóforo marrón distintivo y frutos carnosos rojos. *Monopyle longicarpa* J. L. Clark & Keene tiene indumento viloso dorado y frutos elongados lineares. Ambas especies se diferencian de sus congéneres por la presencia de tricomas pequeños glandulares a lo largo de las márgenes de los lóbulos de la corola.

Key words: Gesneriaceae, IUCN Red List, *Monopyle*, Panama.

Monopyle Moritz ex Benth. (Gesneriaceae, Gloxinieae) is a genus of terrestrial understory or epiphytic herbs distributed from Guatemala southward to northern South America. The genus currently comprises 19 recognized species (Roalson et al., 2005; Keene et al., 2011), including at least three species known from Panama (Skog, 1979). The actual number is much higher because preliminary monographic work suggests that some broadly circumscribed taxa should be more narrowly defined (Keene, in prep.). Additionally, recent exploratory expeditions by the second author have yielded numerous new species not represented in herbaria and collections that have facilitated the recognition of new species poorly represented in herbaria. Here we describe two sympatric species that were collected in 2011 during a research expedition facilitated by Minera Panamá S.A. in the copper mine concession in Colón Province of central Panama.

Monopyle is morphologically complex and has had little attention since Morton's monographic revision (1945). The genus is traditionally characterized by strongly anisophyllous opposite leaves, campanulate white or white with purple flowers, and the presence of uncinate trichomes (Weber, 2004; Roalson et al., 2005). Additional diagnostic characters that define *Monopyle* that were discovered during revisionary work by the first author include variably swollen internodes, a nodal ridge, and the presence of an osmophore (floral fragrance gland) at the base of the corolla. Many *Monopyle* species are presumably locally endemic and appear to be restricted to a specific watershed. It is likely that narrow distributions are the result of the minute seeds limited by a splash-cup dispersal mechanism.

1. Monopyle aurea Keene & J. L. Clark, sp. nov. Type: PANAMA. **Colón:** Distr. Donoso, Conseción de Minera Panamá S. A. Helipad ZP-P9, 8°51′5″N, 80°40′19″W, 391 m, 20 July 2011, *J. L. Clark & L. Martínez 12564* (holotype, US; isotypes, K, MO, NY, PMA, SEL). Figure 1.

Diagnosis. Differs from all other *Monopyle* species by the combination of white corollas suffused with yellow, a dark maroon osmophore, and dark red fleshy fruits.

Terrestrial suffrutescent herb; roots fibrous, shoots erect, red to brown, 0.5–1.5 m tall, to 5 mm diam., pilose to densely pilose with uncinate trichomes intermixed occasionally with long, septate, eglandular

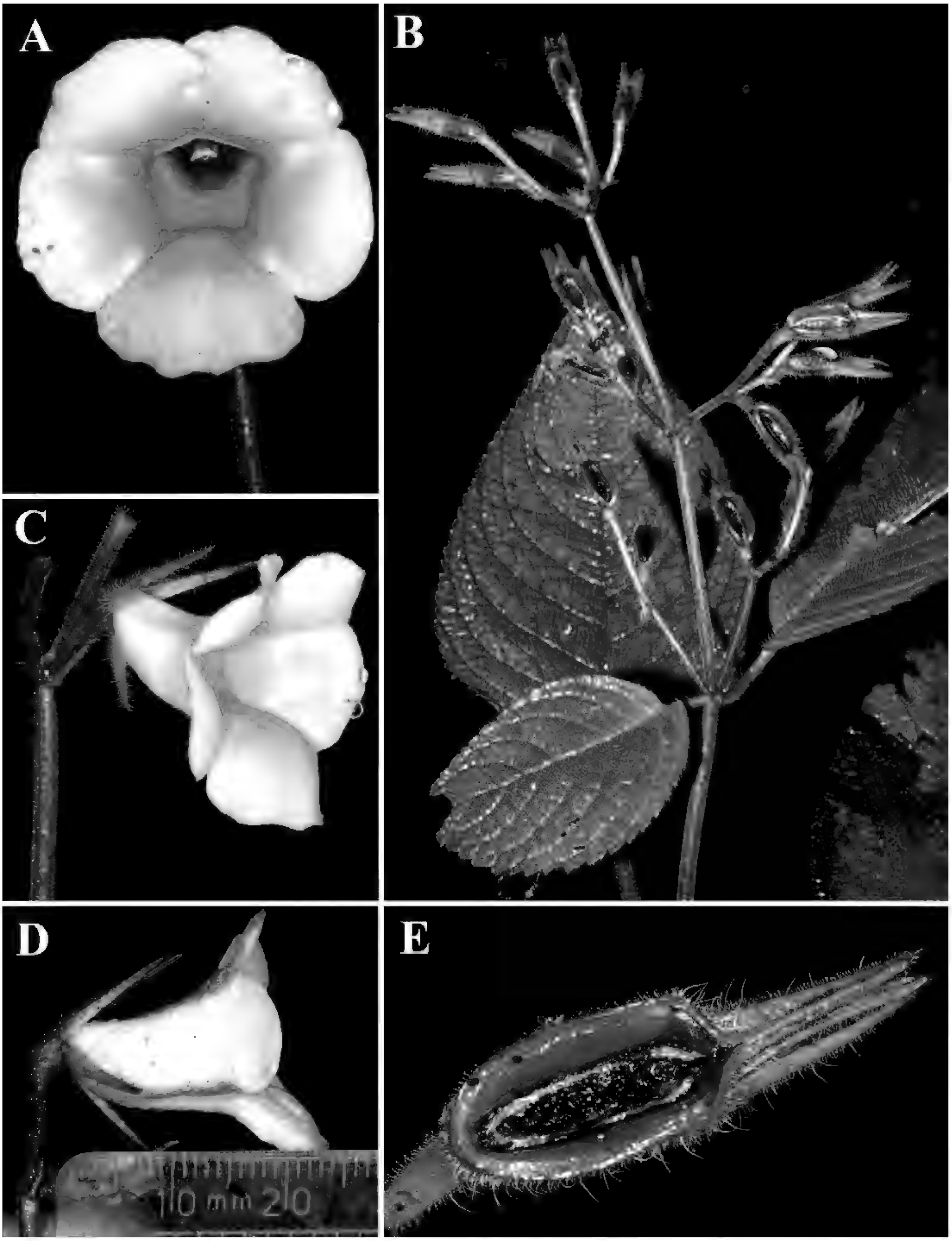


Figure 1. *Monopyle aurea* Keene & J. L. Clark. —A. Face view of flower showing maroon-colored osmophore. —B. Infructescence. —C, D. Lateral views of flower. —E. Mature fruit showing dorsal dehiscence. Photos by J. L. Clark of voucher from the holotype *J. L. Clark & Martínez 12564* (US).

trichomes; lateral shoots present in the axils of leaves. Leaves opposite, strongly anisophyllous, interstipular scar present; the larger leaf of pair with petioles (1.4–)2.9–7.9 cm, villous with eglandular trichomes intermixed with uncinate trichomes on the abaxial surface, lamina asymmetrical ovate to elliptic, base oblique, to 8 mm between bases, apex attenuate to acuminate, (10.3–)13.1–19.9 × (5.6–)7.1–10.8 cm, serrate with a gland at each tooth; adaxially green to red, densely villous at leaf base with eglandular trichomes becoming villous and intermixed with uncinate trichomes toward the apex, abaxially red to maroon, sparsely villous along veins with eglandular trichomes; the smaller leaf of a pair with petioles (0.7–)1.7–4.5 cm, pubescence same as large leaf; lamina ovate to elliptic, base oblique (occasionally cuneate), apex acute to attenuate, (2.5–)5.3–11.2(–13.9) × (1.9–)3.2–6.9(–9.1) cm, serrate; adaxially and abaxially same as large leaf. Inflorescence a terminal, erect, compound cyme; peduncle 34–50 mm, densely pilose with uncinate trichomes intermixed with longer eglandular trichomes, bracts 6–8 × 0.4–1.1 mm, persistent, opposite, adaxially nearly glabrous, abaxially villous with eglandular trichomes; rachis (8.9–)15.7–25.3 cm, 2 to 4 nodes, with 6 to 8 cymules per node; secondary peduncle 15–39 mm, bracteoles 2–4 × 0.5–1 mm; tertiary peduncle 8–13 mm, bracteoles 1–2 × 0.4–0.6 mm; pedicel of terminal flower (12–)22–33 mm, front flower (second flower in a pair) 2–7 mm. Calyx green to maroon, lobes five, linear to lanceolate, 8–13 × 1–2.5 mm, connate 2–6 mm from base, apex acute, abaxially pilose with uncinate trichomes intermixed with long, septate, eglandular trichomes, adaxially nearly glabrous; corolla mostly white suffused with yellow in the throat, 18–24 × 12–15 mm, villous with thin eglandular trichomes, minute gland-tipped trichomes on the inner dorsal surface of the tube (above androecium), osmophore at base of corolla dark maroon; corolla lobes with minute glandular trichomes along the margins, dorsal lobes 6–9 × 4–8 mm, ventral lobe 7–13 × 5–11 mm; androecium of four stamens, 3–7 mm, didynamous, included, filaments 2–6 mm, adnate to corolla, anthers to 1 × 0.6 mm, connivent for ≤ 0.7 mm; nectary usually absent, some flowers with small amounts of raised tissue at the base of the ovary; gynoecium with ovary subinferior, to 1.5 mm wide, densely pilose with uncinate intermixed with eglandular trichomes (mainly at the apex near the base of the style), style to 4.5 mm, glabrous, stigma stomatomorphic. Fruits 8–12 × 2.5–4 mm, accrescent, dehiscing along dorsal surface, interior dark red, calyx persistent in fruit; seeds numerous, ovoid to ellipsoid, with many tube-shaped protuberances, 0.3–0.4 × 0.2–0.3 mm, dark brown to black.

Phenology. *Monopyle aurea* was collected in flower in February, June, July, and November and in fruit during February and July.

Distribution and habitat. *Monopyle aurea* is endemic to Panama and is only known from six collections from the adjacent provinces of Colón and Coclé. The lowland forest (i.e., below 500 m) of the Caribbean slope where *M. aurea* is abundant is classified as Tropical Wet Forest (Holdridge 1967). The habitat for the type locality was the understory of shaded mature forest along small streams where there were at least two populations of 15+ individuals.

Conservation and IUCN Red List category. According to the IUCN Red List criteria (IUCN, 2001) for limited geographic range (B2a, severely fragmented or known to exist at no more than five locations), and considering the uncertain future of habitat conservation in the area, *Monopyle aurea* should be listed as EN (Endangered).

Etymology. The specific epithet, *aurea*, refers to the white suffused with yellow color in the corolla throat. In contrast, most species of *Monopyle* have blue corollas. The only other known species of *Monopyle* with yellow flowers is *M. flava* L. E. Skog.

Paratypes. PANAMA. **Coclé:** area between Caño Blanco del Norte, Caño Sucio and Chorro del Río Tife, 3 Feb. 1983, *G. Davidse & C. Hamilton 23544* (MO); rd. from La Pintada to Coclesito, 7 Feb. 1983, *C. Hamilton & G. Davidse 2816* (MO); trail from Río San Juan to Río Tife Falls, 10 June 1978, *B. Hammel 3378* (MO); Caribbean side of the divide at El Copé, 4 Feb. 1983, *C. Hamilton & G. Davidse 2710* (L, MO). **Colón:** Teck Cominco Petaquilla Mining Concession, 30 Nov. 2007, *G. McPherson 19902* (MO).

2. Monopyle longicarpa J. L. Clark & Keene, sp. nov. TYPE: Panama. **Colón:** Distr. Donoso, Conseción de Minera Panamá S. A. Helipad ZP-P9, 8°51′5″N, 80°40′19″W, 391 m, 20 July 2011, *J. L. Clark & L. Martínez 12563* (holotype, US; isotypes, K, MO, NY, PMA, SEL). Figure 2.

Diagnosis. Differs from all other *Monopyle* species by the combination of villous golden indument on all vegetative surfaces and elongate linear cream to greenish fruit.

Terrestrial herb; roots fibrous, shoots dorsiventral, golden to dark red at the base, 20–40 cm tall, 2.5–5 mm diam., villous with long, septate eglandular (occasionally glandular) golden trichomes (indument on all vegetative surfaces); lateral shoots absent in the axils of leaves. Leaves opposite, strongly anisophyllous, interstipular scar present; the larger leaf of pair with petioles (4–)7–17 mm, densely villous, lamina asymmetrical ovate to elliptic, base oblique, to 13

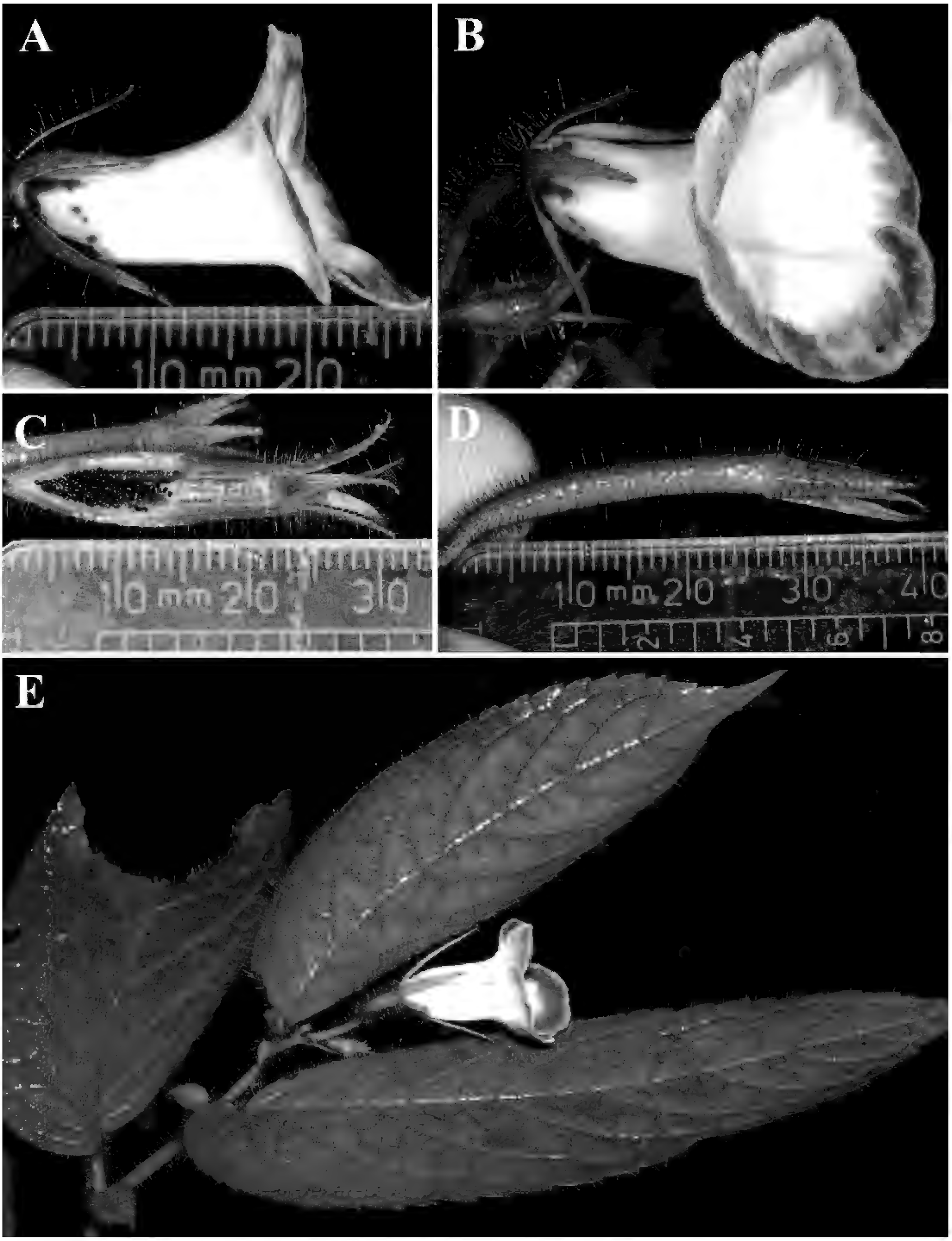


Figure 2. *Monopyle longicarpa* J. L. Clark & Keene. —A, B. Lateral views of flower. —C. Mature fruit showing dorsal dehiscence. —D. Immature fruit. —E. Dorsiventral shoot with anisophyllous leaves. Photos by J. L. Clark of voucher from the holotype *J. L. Clark & L. Martínez 12563* (US).

mm between bases, apex acuminate, (5.1–)8.6–23.3 × 3.0–5.8(–8.1) cm, subentire to serrate; adaxially dark green (occasionally suffused red), villous, abaxially dark green to maroon, villous (more so on veins); the smaller leaf of a pair with petioles to 5 mm (some appearing sessile), villous; lamina ovate to orbicular, base oblique (appearing equilateral), apex acuminate to cuspidate, 0.9–2.4 × 0.5–1.2 cm, entire to serrate toward the apex; adaxially and abaxially similar to larger leaf. Inflorescence a terminal, erect, compound cyme; peduncle 41.6–50.3 mm, densely villous, bracts 3–5 × 0.5–1 mm, persistent, opposite, adaxially nearly glabrous, abaxially villous; rachis 35.4–41.6 cm, 2 or 3 nodes, with 2 cymules per node; secondary peduncle 5–9 mm, bracteoles 1–2 × 0.2–0.4 mm; pedicel 6–9 mm. Calyx green to maroon, lobes five, linear, 11–15 × 1–2 mm, connate 4–8 mm from base, apex acute, reflexing, abaxially villous, adaxially nearly glabrous; corolla white with varying amounts of violet, 18–24 × 10–13 mm, pilose with thin eglandular trichomes, minute gland-tipped trichomes on the inner dorsal surface of the tube (inserted above androecium), osmophore present (likely yellow to orange); corolla lobes with minute glandular trichomes along margin of the lobes, dorsal lobes 7–9 × 4–6 mm, ventral lobe 9–11 × 6–7 mm; androecium with four stamens, 4–5 mm, didynamous, included, filaments 3–5 mm, adnate to corolla, anthers 0.8–1.1 × 0.5–0.7 mm, connivent for ≤ 1 mm; nectary usually absent, some flowers with small amounts of raised tissue at the base of the ovary; gynoecium with ovary subinferior, to 1.6 mm wide, densely pilose with eglandular trichomes (mainly at the apex near the base of the style), style to 5.6 mm, glabrous, stigma stomatomorphic with a flap of tissue surrounding the dorsal surface. Fruits 13–25 × 2–2.5 mm, accrescent, dehiscing along dorsal surface, interior cream to greenish, calyx persistent in fruit; seeds numerous, ovoid to ellipsoid, with many tube-shaped protuberances, 0.3–0.5 × 0.2–0.5 mm, dark brown to black.

Phenology. *Monopyle longicarpa* was collected in flower and fruit in June and July.

Distribution and habitat. *Monopyle longicarpa* is endemic to Panama and is known from only two collections near the type locality in Colón Province. The lowland forest (i.e., below 500 m) of the Caribbean slope where *M. longicarpa* is abundant is classified as Tropical Wet Forest (Holdridge 1967). The habitat for the type locality was the understory of shaded mature forest along small streams where there were at least two populations of 15+ individuals

Conservation and IUCN Red List category. The only known populations of *Monopyle longicarpa* are located inside a region that will be developed for a copper mine by the Conseción Minera Panamá S. A. There are no known populations outside the copper mine concession, and therefore significant efforts are being implemented by the Conseción Minera Panamá S. A. to cultivate and transplant *M. longicarpa*. These conservation efforts are ongoing for *M. longicarpa* and other species as a way to mitigate the impact on biodiversity when the mine is implemented. According to the IUCN Red List criteria (IUCN, 2001) for limited geographic range (B2a, less than 10 km^2 and known to exist at only a single location), and considering the uncertain future of the region, *M. longicarpa* should be listed as CR (Critically Endangered).

Etymology. The specific epithet, *longicarpa*, refers to the elongate linear fruits (Fig. 2C).

Discussion. *Monopyle longicarpa* is easily differentiated from all other congeners by its elongate fruits, which reach 2.5 cm in length (Fig. 2C). Most fruits of *Monopyle* are less than 1.5 cm in length. *Monopyle longicarpa* is vegetatively distinct by the villous golden indument on all vegetative surfaces, in contrast to the pilose dark brown to black indument in other species of *Monopyle*.

Paratypes. PANAMA. **Colón:** Distr. Donoso. Área del proyecto minero Petaquilla, Valle Grande, Río Petaquilla, 7 June 2009, *B. Araúz, P. Moreno & J. I. González 1870* (MO).

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Aspidistra ovatifolia (Asparagaceae), a New Species from Guangxi, China

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Abstract. *Aspidistra ovatifolia* Yan Liu & C. R. Lin (Asparagaceae) is described and illustrated as a new species from limestone slopes in the Guangxi Zhuangzu Autonomous Region in southern China. The new species is similar to *A. longanensis* Y. Wan in the shape of flower, but differs by its perianth lobes that are triangular, 3–5 mm long, monocyclic, adaxially white, and the stigma 12–16 mm in diam., and adaxially creamy white and glabrous, with the central portion shallowly convex with four radial, bifurcate lines. The new species is currently known only from southwestern Guangxi, near the border with northern Vietnam.

Key words: Asparagaceae, *Aspidistra*, China, Guangxi, IUCN Red List.

The genus *Aspidistra* Ker Gawl. in the Asparagaceae (Angiosperm Phylogeny Group, 2009; Chase et al., 2009), is distributed in eastern Asia, with 60 species mainly in southern and southwestern China and adjacent Vietnam (Liang & Tamura, 2000; Li, 2004; Tillich, 2008, 2014). In May 2007, while investigating limestone habitats in the Guangxi Zhuangzu Autonomous Region, China, near the border with northern Vietnam, we collected an unusual *Aspidistra* specimen in Daxin County. The plants were then brought into cultivation in Guilin Botanical Garden for study. During the next three years, they flowered regularly, making possible a detailed description from living material. Upon careful comparison with all known species in *Aspidistra* (Wan, 1985; Lang et al., 1999; Tang & Liu, 2003; Bogner & Arnautov, 2004; Brauchler & Ngoc, 2005; De Wilde & Vogel, 2005; Tillich, 2005, 2006; Hou et al., 2009; Lin et al., 2009, 2010; Meng et al., 2014), these plants are distinguished as a distinct species new to science.

Aspidistra ovatifolia Yan Liu & C. R. Lin, sp. nov. TYPE: China. Guangxi Zhuangzu Autonomous Region: Daxin Co., Leiping Township, on limestone in a valley, 260 m, 18 May 2007, *Yan Liu L1456* (holotype, IBK; isotype, PE). Figures 1, 2A–E.

Species nova forma urceolata perianthii *Aspidistrae longanensi* Y. Wan proxima, sed ab ea lamina foliari ovata usque late lanceolata, perianthii tubo 10–14 × 15–20 mm adaxialiter longitudinaliter 8-sulcato, lobis uniseriatis triangularibus 3–5 mm longis adaxialiter albis, stigmate glabro 12–16 mm diam. area centrali non alte convexa lineis 4 bifurcatis cruciatim dispositis praedita recedit.

Herbs perennial, evergreen, rhizomatous; rhizomes creeping, subterete, 6–8 mm thick, covered with scales, nodes closely aggregated. Sheathing leaves 4 or 5, purple-red, 1–7 cm, subtending petiole base of blade-bearing leaves, sheaths becoming black-brown when dry; leaves solitary per node, ca. 1 cm apart; petioles stiffly upright, 10–18 cm, 2–3 mm thick, adaxially sulcate; leaf blades usually ovate to widely lanceolate, 9–16 × 6–9.5 cm, dark green with small yellow spots on both surfaces, blade base broadly cuneate to suborbicular, abruptly narrowing into petiole, inequilateral, apex cuspidate to acuminate, margin entire. Peduncle decumbent, purplish red, 1.8–4 cm, with 4 to 6 bracts, terminal 3 or 4 bracts, close to flower; two bracts at the base of perianth widely ovate, white with purplish red spots, ca. 1 × 1–1.5 cm, apex subobtuse; flowers solitary. Perianth uniseriate, urceolate, fleshy, slightly 8-lobed apically; perianth tube 10–14 × 15–20 mm, abaxially white with purplish red spots, adaxially deep purple to nearly black, with 8 longitudinal grooves extending from stamen bases to mouth of perianth tube; perianth lobes suberect, triangular, 3–5 × 2–3 mm at base, abaxially white and densely purple-mottled, adaxially white, sometimes with purplish red speckles at base, each lobe basally with an adaxial, white, toothlike appendage, ca. 2 × 2 mm, apex 2- or 3-denticulate, appendages protruding horizontally or obliquely over perianth tube central opening similar to a ring and reducing this opening to 4–5 mm diam.; stamens 8, opposite perianth lobes, inserted at ca. 2 mm from the base of perianth tube, positioned conspicuously lower than stigma; anthers subsessile, oblong, 1.2 × 0.8 mm, dehiscing by a longitudinal slit; pistil 8–10 mm, ovary indistinct, style cylindrical, 2–3 mm, stigma peltate, enlarged,

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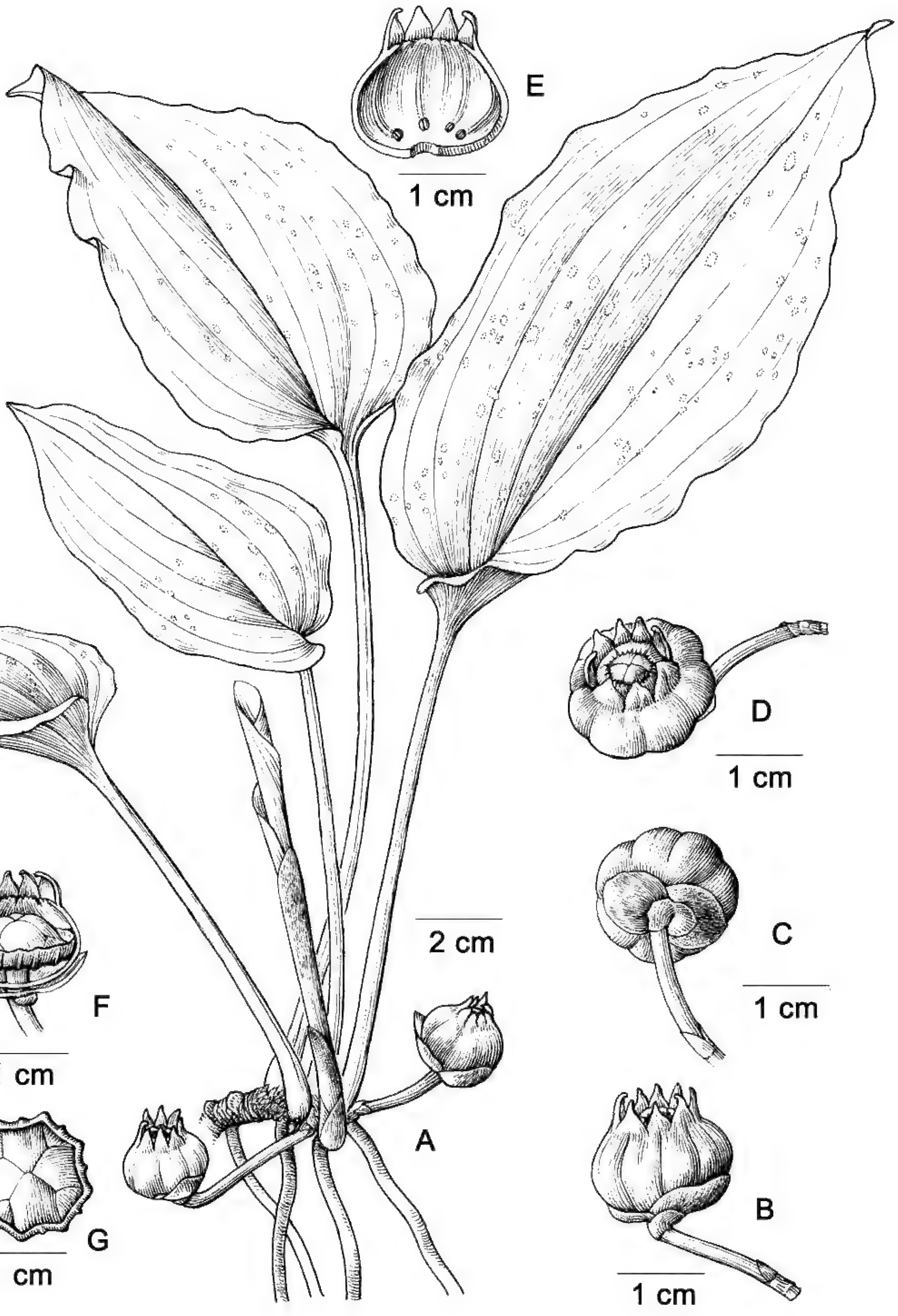


Figure 1. *Aspidistra ovatifolia* Yan Liu & C. R. Lin. —A. Flowering plant. —B. Flower, lateral view. —C. Basal view of flower, revealing bracts. —D. Flower, apical view. —E. Internal view of perianth, longitudinal section showing stamens. —F. Flower, longitudinal section, with half of perianth removed to reveal the peltate pistil. —G. Stigma, apical view. A–G drawn by Shun-Qing He from the holotype *Yan Liu LI456* (IBK).

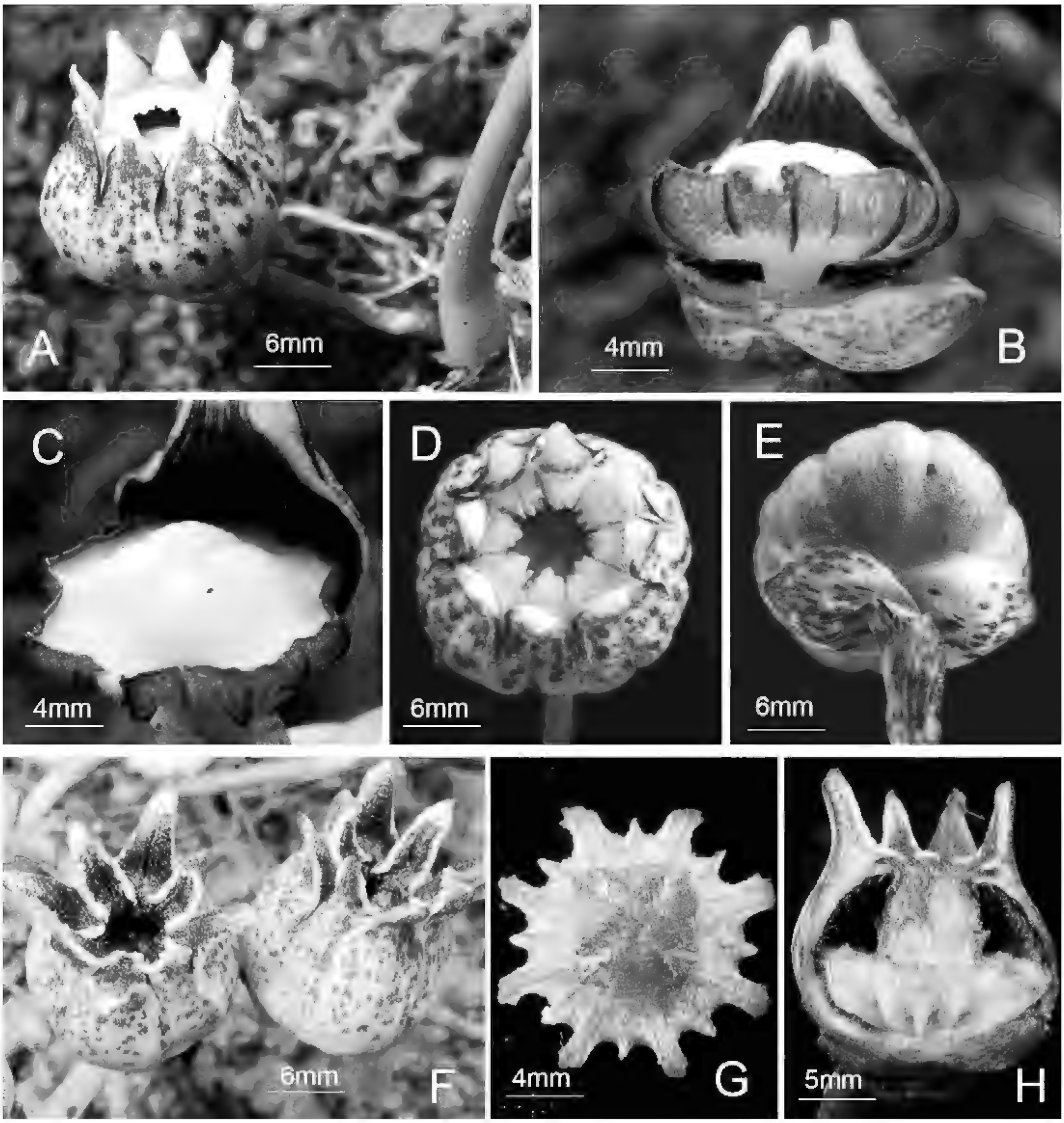


Figure 2. A–E, *Aspidistra ovatifolia* Yan Liu & C. R. Lin. —A. Flower. —B. Stigma in lateral view. —C. Stigma from apical view. —D. Flower from apical view. —E. Basal view of flower, showing bracts. F–H, *Aspidtra longanensis* Y. Wan. —F. Two flowers. —G. Stigma from apical view. —H. Stigma in lateral view. A–H, taken from plants cultivated at the Guilin Botanical Garden.

6–8 mm high, 12–16 mm diam., upper surface creamy white, glabrous, central portion shallowly convex with 4 radial, bifurcate lines, stigmatic margin purple-red and bent upward, rounded octagonal, with 16 longitudinal ribs.

Distribution and habitat. *Aspidistra ovatifolia* was collected from shaded rocky limestone slopes. The new species is found only in the type locality in Leiping Township, Daxin County, Guangxi, China.

IUCN Red List category. Recent observations show that the population size of this new species is small and that it is confined to one site. We therefore assess *Aspidistra ovatifolia* as Critically Endangered (CR), using the IUCN categories and criteria (IUCN 2001).

Phenology. *Aspidistra ovatifolia* was observed to flower from April to May.

Etymology. The specific epithet *ovatifolia* is derived from its ovate leaves.

Discussion. *Aspidistra ovatifolia* is similar to *A. longanensis* Y. Wan (Wan, 1985; Liang & Tamura, 2000; Figure 2F–H) in the urceolate shape of flower (vs. subcampanulate in *A. longanensis*). The new species also differs in its perianth lobes that are smaller, 3–5 mm long (vs. 9–10 mm), and adaxially white (vs. blue-purple) and the stigma 12–16 mm in diam. (vs. 10–12 mm diam.). Further morphological and detailed comparison of the two species is presented in Table 1.

Paratype. CHINA. **Guangxi:** Guilin Bot. Garden, cultivated by Yan Liu from plants taken from the type locality, 25 May 2009, *Chun-Rui Lin 019* (IBK).

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Four of Queens: Shuffling New *Barbacenia* from Brazil (Velloziaceae)

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Abstract. Four new species of *Barbacenia* Vand. (Velloziaceae) from Bahia and Minas Gerais, Brazil, are described. *Barbacenia piranga* Mello-Silva, *B. serracabralea* Mello-Silva, *B. tuba* Mello-Silva & N. L. Menezes, and *B. vellozioides* Mello-Silva combine characteristics ascribed to *Aylthonia* N. L. Menezes and *Pleurostima* Raf., which have been split from *Barbacenia* s.l. *Barbacenia serracabralea* shares leaf trichomes similar to those of *Aylthonia*, the anther insertion and stigmas of *Pleurostima*, and fruits similar to those of *Barbacenia*. *Barbacenia piranga* and *B. tuba* show tristichous phyllotaxis, serrulate leaf margins and basifixed anthers that would fit *Pleurostima*, but the long hypanthial tube, short apical, confluent stigmas lobes, and the loculicidal capsules of *B. tuba* correspond to those seen in *Aylthonia*. In *B. vellozioides*, the basifixed anthers and lateral stigma lobes would suggest placement in *Pleurostima*. Nevertheless, its capsule is not dehiscent by many intercostal openings, as in *Pleurostima*, but rather by apical pores. For these reasons, beyond obscuring the alleged distinctions among these three genera, these four are new entities. They are special also for their beauty and rarity.

Resumo. São descritas quatro espécies novas de *Barbacenia* Vand. (Velloziaceae), da Bahia e de Minas Gerais, Brasil. *Barbacenia piranga* Mello-Silva, *B. serracabralea* Mello-Silva, *B. tuba* Mello-Silva & N. L. Menezes, and *B. vellozioides* Mello-Silva combinam características atribuídas aos gêneros *Aylthonia* N. L. Menezes e *Pleurostima* Raf., desmembrados de *Barbacenia* s.l. *Barbacenia serracabralea* agrega tricomas foliares de *Aylthonia*, inserção das anteras e estigmas de *Pleurostima* e frutos de *Barbacenia*. *Barbacenia piranga* e *B. tuba* combinam filotaxia trística, folhas serruladas e anteras basifixas, que seriam típicas de *Pleurostima*, com tubo do hipanto longo, estigmas curtos e confluentes no ápice, e cápsulas loculicidas de *B. tuba*, que seriam típicas de *Aylthonia*. As anteras basifixas e os estigmas laterais de *B. vellozioides* sugeririam sua classificação em *Pleurostima*. No entanto, suas cápsulas são deiscentes por poros apicais e não por aberturas intercostais típicas de *Pleurostima*. Por isto, além de obscurecer as alegadas distinções entre esses três gêneros, elas constituem novas espécies. São distintas também por sua beleza e raridade.

Key words: *Barbacenia*, Brazil, IUCN Red List, Velloziaceae.

Barbacenia Vand. (Velloziaceae) comprises fewer than 100 species (Mello-Silva, 2010), which are endemic to the Neotropics (Mello-Silva et al., 2011) and have reached maximum diversity in relatively dry, rocky, or sandy habitats in the Espinhaço Range in Brazil (Mello-Silva, 2004). The genus has been treated as a large taxon (e.g., Seubert, 1847; Smith & Ayensu, 1976), or split into *Aylthonia* N. L. Menezes, *Barbacenia*, *Burlemarxia* N. L. Menezes & Semir, and *Pleurostima* Raf. (Rafinesque, 1837; Menezes, 1971, 1980a; Menezes & Semir, 1991; Kubitzki, 1998). The four new species here described are remarkable, not only for their beauty and rarity, but also for several characteristics once ascribed to *Aylthonia* or to *Pleurostima*. Like *Barbacenia lymansmithii* Mello-Silva & N. L. Menezes (Mello-Silva & Menezes, 1999), these new species challenge the delimitation of the segregate genera and reinforce cladistic analyses that support the recognition of *Barbacenia* in its broader sense (Mello-Silva, 2005; Mello-Silva et al., 2011). The new species also attest to the richness of phytochoria in the campo rupestre archipelago (Prance, 1994) and the Espinhaço range region (Giulietti et al., 1997), which encompass the greater part of the diversity assigned to the cerrado hotspot (Mendonça et al., 1997; Myers et al., 2000). Three of the new species, *B. piranga* Mello-Silva, *B. tuba* Mello-Silva & N. L. Menezes, and *B. vellozioides* Mello-Silva are from the state of Bahia; *B. tuba* is relatively widespread, and the other two are more restricted. The fourth new species, *B. serracabralea* Mello-Silva, is endemic to one massif in the state of Minas Gerais.

1. Barbacenia piranga Mello-Silva, sp. nov. TYPE: Brazil. Bahia: Abaíra, Ouro Fino, 13°15′S, 41°54′W, 1700 m, 24 Mar. 1992 (fl.), *T. Laessøe*,

W. Ganev & T. R. S. Silva H53332 (holotype, SPF; isotypes, CEPEC not seen, HUEFS not seen, K, MO, RB, US). Figures 1, 5A.

Foliorum costa abaxiliter sicut margine serratis et pedicello hypanthioque longis *Barbaceniae graminifoliae* L. B. Sm. proxime affinis, sed ab ea foliis tristichis, emergentiis hypanthii saepe glandulosis raro eglandulosis et antheris ad partem tertiam basalem loborum coronae adnatis differt; etiam habitatione prope rivulos vel locos petrosos humidosque hae species duabus similes.

Caespitose; stems 9–80 cm. Leaves tristichous; leaf sheaths light brown, ± exposed; leaf lamina plane, older ones marcescent, reflexed, 12–32 cm × 4–9 mm, linear-triangular, long attenuate, sparsely ciliate to serrate on margins and on abaxial midrib, sometimes almost smooth, trichomes longer toward lamina base. Flowers solitary; peduncle 10–26 cm, circular in transverse section, smooth to sparsely covered with glandular emergences toward apex. Flower with hypanthium 2.5–4.5 cm; sparsely covered with glandular emergences, mostly on costae, sometimes with small eglandular emergences, almost smooth; portion fused to ovary terete-fusiform to obovoid, 9–20 × 3–6 mm, red-vinaceous, hypanthial tube 1.5–3 cm, 3–6 mm wide at base, 6–8 mm wide at apex, red-vinaceous to red; perianth oblong to lanceolate, 25–40 × 3–6 mm, red-vinaceous to red on abaxial side, bright red on adaxial side; sepals sparsely covered with small to sessile glandular, or sometimes eglandular, emergences on abaxial side, adaxially glabrous; petals glabrous except for sparsely sessile glandular, or sometimes eglandular, emergences on central vein abaxially; corona lobes trapezoidal to trapezoidal-oblong, 5–15 × ca. 2 mm, vinaceous to pinkish red, bidentate at apex, lobules triangular, 0.5–1 mm; anthers 1–3 cm, yellow, basifixed, auriculate at base, inserted on proximal third of corona lobes, connective pinkish white or green, slightly appendiculate at apex; style 3.5–5 cm, red-vinaceous to red, stigma capitate, 3 lobes confluent at apex, yellow to whitish yellow. Capsule not seen.

Leaf anatomy (from the type *Laessøe et al. H5333*). Blade inconspicuously dorsiventral; cuticle thickened on both surfaces; stomata present on abaxial surface only, between fibro-vascular bundles; epidermis uniseriate; spongy parenchyma near fibro-vascular bundles and aquiferous parenchyma occupying almost all space between bundles; fibro-vascular bundles surrounded by a distinct bundle sheath, 1 (or 2) large vessels present in each fibro-vascular bundle; phloem strands 2, separated by parenchymatous or sclerified cells; fibers extending as girders to epidermis on both sides, adaxial girder narrowly obtrapeziform in outline, larger than abaxial girder.

Etymology. The solitary, showy, quite distinctive, and beautiful flowers are reddish, hence the epithet, *piranga*, from the Tupi language (Ferreira, 1978; Bueno, 2008).

Distribution and habitat. *Barbacenia piranga* occurs in the restricted and most elevated portion of the Espinhaço Range of Bahia State, in Rio de Contas, Piatã, and Abaíra. It has been collected at elevations from 850 to 1500 m. Like other species of the family, *B. piranga* was consistently found in the proximity of creeks. The new species flowers from late December to late March, but no fruits have been found.

IUCN Red List category. *Barbacenia piranga* is distributed over a relatively extended region, with populations over non-utilizable grounds. Thus its conservation status would probably be Least Concern (LC), according to IUCN (2001) criteria.

Discussion. *Barbacenia piranga* resembles *B. graminifolia* L. B. Sm. They share a serrulate leaf margin and midrib, and both have long pedicellate flowers reddish in color with long hypanthia. The two taxa share a preference for proximity to water streams or humid, rocky places. *Barbacenia graminifolia* presents spirotristichous phyllotaxis and a hypanthium with eglandular emergences, and anthers are attached to the apex of corona lobes. In comparison, *B. piranga* presents tristichous phyllotaxis, the hypanthial emergences are rarely eglandular, and the anthers are attached to the proximal third of the corona lobes.

Paratypes. BRAZIL. **Bahia:** Mun. Rio de Contas, Palmeiras, próximo à Cachoeira da Michilana, 13°24′S, 41°47′W, 27 Dec. 1993 (fl.), *W. Ganev 2704* (HUEFS, SPF); Mun. Abaíra, Barra, 13°18′S, 41°46′W, 9 Jan. 1992 (fl.), *A. M. Giulietti, R. M. Harley & A. F. Fierro H51240* (CEPEC not seen, HUEFS not seen, K not seen, SPF); Mutuca, 13°22′S, 41°50′W, 21 Mar. 1992 (fl.), *B. L. Stannard, T. R. S. Silva & W. Ganev H52735* (CEPEC not seen, HUEFS not seen, K not seen, SPF); Mun. Piatã, Salão, divisa Piatã/Abaíra, 13°16′S, 41°43′W, 23 Dec. 1992 (fl.), *W. Ganev 1734* (HUEFS, K not seen, SPF).

2. Barbacenia serracabralea Mello-Silva, sp. nov. TYPE: Brazil. Minas Gerais: Mun. Joaquim Felício, Serra do Cabral, estrada Joaquim Felício-Várzea da Palma, 15.5 km além da ponte sobre o Córrego da Onça, alto da serra, 17°44′53″S, 44°15′41″W, 1150 m, 26 Jan. 2004 (fl., fr.), *R. Mello-Silva, J. R. Pirani, M. F. A. Calió, K. B. Lepis, R. Riina & J. Lovo 2505*

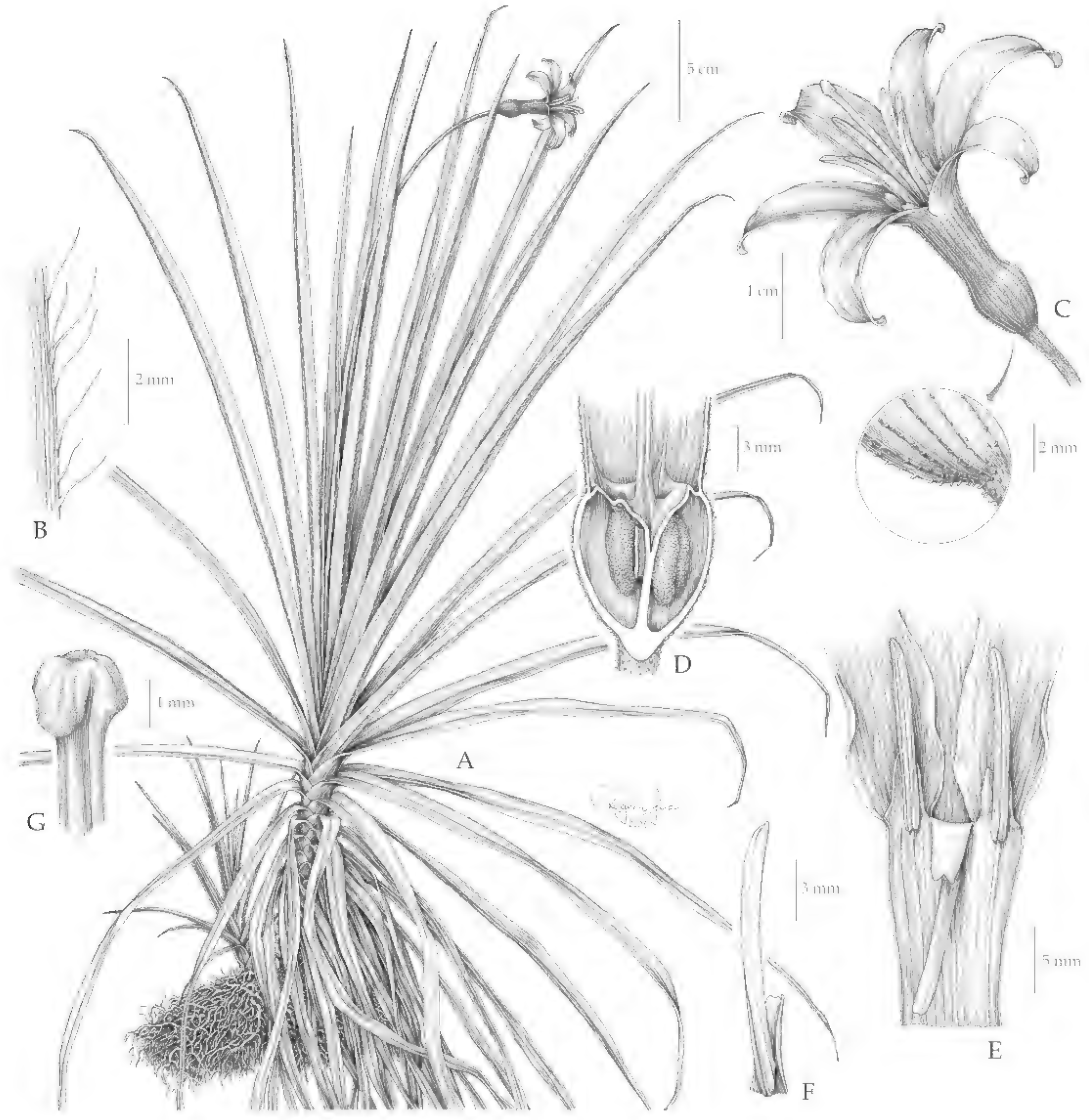


Figure 1. *Barbacenia piranga* Mello-Silva. —A. Habit. —B. Leaf margin. —C. Flower showing detail of hypanthium emergences. —D. Longitudinal section of proximal region of hypanthium and ovary. —E. Longitudinal section of distal region of hypanthium, showing insertion of corona lobes and perianth. —F. Corona lobe with anther. —G. Apex of style with stigma lobes confluent at apex. A, B drawn from the paratype *A. M. Giulietti, R. M. Harley & A. F. Fierro H51240* (SPF); C–G drawn from the holotype *T. Laessøe, W. Ganev & T. R. S. Silva H53332* (SPF).

(holotype, SPF; isotypes, B, BHCB, K, L, M, MBM, MO, NY, RB, SP, US). Figures 2, 5B.

Facie ad *Barbaceniam delicatulam* L. B. Sm. & Ayensu et *B. minimam* L. B. Sm. & Ayensu accedit, autem ab eis floribus semper violaceis, hypanthio emergentiis subulatis eglandulosis sparse instructo et capsulis primo poricidalibus differt.

Caespitose; stems 5–100 cm, 0.5–1 cm wide at apex. Leaves tristichous; leaf sheaths whitish at base, hidden; leaf lamina arcuate, odoriferous, older ones marcescent, reflexed, 6–14 cm × 2–5 mm, linear-triangular, long attenuate, long to short ciliate on margins and on abaxial midrib, trichomes longer toward lamina base. Flowers 1 to 3; pedicels 1.5–2.5 cm, circular in transverse section, brownish, sparsely covered with subulate eglandular emergences toward apex. Flower with the hypanthium 3–9 mm, campanulate, sparsely covered with thinly subulate eglandular emergences; greenish white to violaceous-white; perianth oblong to lanceolate, 4–10 × 2–3 mm, violet, lighter toward base and on midrib; sepals apiculate,

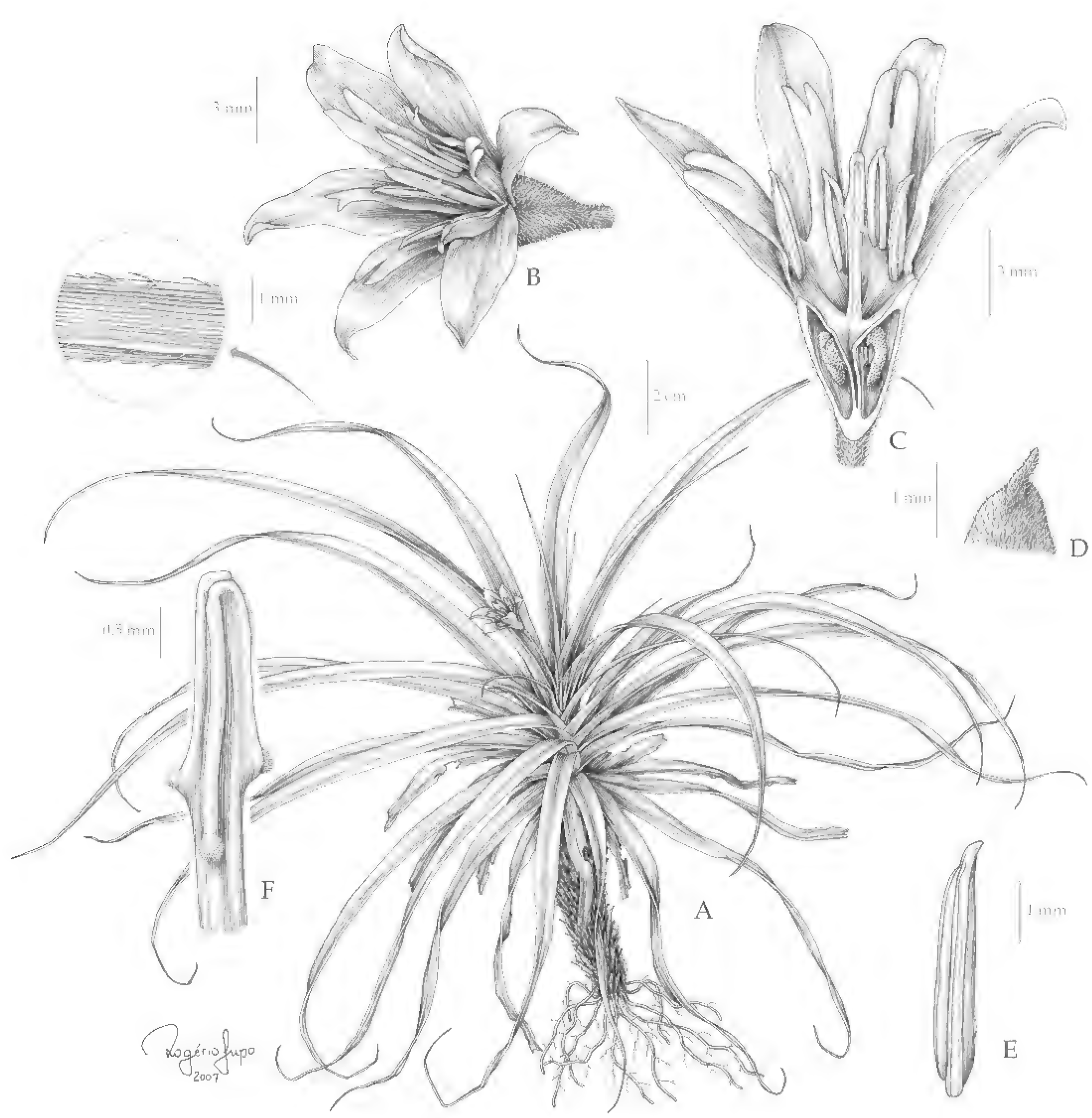


Figure 2. *Barbacenia serracabralea* Mello-Silva. —A. Habit, showing detail of abaxial side of leaf. —B. Flower. —C. Longitudinal section of flower. —D. Apex of sepal, abaxial view. —E. Anther, frontal view. —F. Apex of style with stigma lobes confluent at apex and three lateral stigmatiferous regions. Drawn from the holotype *R. Mello-Silva, J. R. Pirani, M. F. A. Calió, K. B. Lepis, R. Riina & J. Lovo 2505* (SPF).

slightly narrower, sparsely covered with thin subulate eglandular emergences on abaxial side, glabrous adaxially; petals glabrous except for similar emergences on the central vein abaxially; corona lobes oblong, 4–7 × 1–1.5 mm, violet to rarely cream, deeply bidentate at apex, lobules narrowly triangular, ca. 1 mm; anthers 3–5 mm, light violaceous, basifixed, slightly auriculate at base, appendicular at apex, inserted on corona lobes base; pollen yellow; style 4–6 mm, clavate, whitish violaceous above stigmatic region, whitish below, stigma lobes confluent at apex, whitish, stigmatic regions 3 in upper 3/5 of style, circular. Capsule 7–10 × 7–9 mm, globose to subglobose, dehiscent initially by three apical pores, then through lateral walls; seeds reniform, ca. 1 mm, alveolate, dark castaneous.

Leaf anatomy (from the type *Mello-Silva et al. 2505*). Blades dorsiventral; abaxial furrows about 1/2 thickness of blade; multiseriate trichomes present on margins, abaxial mid-vein and furrows; cuticle slightly thickened on both surfaces; stomata present inside furrows only; epidermis uniseriate; adaxial hypodermis biseriate, with bundles of sclerified cells; palisade mesophyll 3 or 4 cell layers thick, grading into spongy parenchyma; fibro-vascular bundles

surrounded by a distinct bundle sheath, 1 (or 2) large vessels present in each fibro-vascular bundle; phloem strands 2, separated by parenchymatous or sclerified cells; fibers extending as girders, adaxially to hypodermis and abaxially as inverted Y-shaped girders extending along abaxial surface on both sides and curving upward along part of the furrows.

Etymology. The epithet for the new species is to be regarded as a Latinized noun in apposition, and is taken from the poetic Portuguese *serra cabrália*, meaning Serra do Cabral.

Distribution and habitat. *Barbacenia serracabralea* is endemic to Serra do Cabral, a disjunct massif nearby and west of the central part of the Espinhaço Range in the state of Minas Gerais. The new species grows on rocky grooves on sandstone inselbergs, from which the elongate stems, sometimes to 1 m long, hang. Only the one collection is known, with flowers and fruits collected in late January.

IUCN Red List category. Only one population of *Barbacenia serracabralea* is so far known. It inhabits a rocky outcrop near the main road that crosses the Serra do Cabral. Those outcrops abound in the Serra, a region that has scarcely been botanically explored. Thus many more individuals are expected to exist in the area, as the Velloziaceae species are almost always represented by large populations. Nevertheless, adequate data are not available and it should be considered Data Deficient (DD), according to IUCN (2001) criteria.

Discussion. *Barbacenia serracabralea* shares a similar general appearance with *B. delicatula* L. B. Sm. & Ayensu, which is endemic to Serra do Cipó, in the southern part of the Espinhaço Range in Minas Gerais, and to *B. minima* L. B. Sm. & Ayensu, of a poorly known distribution (Smith & Ayensu, 1979), but which also occurs in Serra do Cabral. Morphologically, *B. serracabralea* shares with *B. minima* the presence of furrows on the abaxial surface of the leaf blade, which is rare among species of *Barbacenia* (Mello-Silva, 2000, 2005). The three species differ mainly in flower color and indumentum, generally white and totally glabrous in *B. delicatula*; yellow and stipitate glandular in *B. minima*; and, in marked contrast, violet to whitish violet flowers and eglandular emergences in the new species. And in *B. delicatula*, the fruits are capsules that dehisce by many intercostal openings. The three species would correspond perfectly with the segregate *Pleurostima* sensu Menezes (1980a, 1980b) were it not for the leaf indument and the poricidal capsule of *B. serracabralea*. The multicellular trichomes, present on lamina and furrows, would be characteristic of many *Aylthonia* species, and the poricidal capsule is an attribute of other *Barbacenia* as well as several *Vellozia* Vand. species (e.g., *B. ignea* Mart. ex Schult. & Schult. f. and *V. variabilis* Mart. ex Schult. & Schult. f.). This intermixing of characters renders questionable the recognition of genera previously segregated from *Barbacenia* by Menezes (1980a, 1980b).

3. Barbacenia tuba Mello-Silva & N. L. Menezes, sp. nov. TYPE: Brazil. Bahia: Mucugê, estrada Andaraí-Mucugê, estrada nova, a 13 km de Mucugê, próximo a grande pedreira, na margem esquerda, 21 July 1981 (fl.), *J. R. Pirani, I. Cordeiro, A. Furlan, J. Semir, N. L. Menezes, A. M. Giulietti & L. Rossi CFCR1666* (holotype, SPF; isotypes, HUEFS, K, M, MO, RB, US). Figures 3, 5C.

Foliorum costa abaxialiter sicut margine serratis, pedicello hypanthioque longis *Barbaceniae graminifoliae* L. B. Sm. et *B. plantagineae* L. B. Sm. appropinquat, sed ab eis hypanthio viridi flavidoviridi flavove, tepalis flavidoridibus subroseisve et hypanthii emergentiis glandularibus distinguitur; etiam habitatione prope rivulos vel locos petrosos humidosque hae species tribus similes.

Caespitose; stems 6–150 cm. Leaves tristichous; leaf sheaths light brown, purple-tinged at apex, ± exposed; leaf lamina arcuate, older ones twisted from apex, marcescent, reflexed, 6–22 cm × 6–16 mm, narrowly oblong, abruptly acuminate, ciliate trichomes present on margins, longer toward lamina base, on central vein abaxially and sometimes adaxially. Flowers 1 (to 3); pedicels 11–24 cm, circular in transverse section, sparsely covered with glandular emergences toward apex. Flower with hypanthium 2.5–4 cm; hypanthial section fused to ovary terete-fusiform, 6–12 × 4–7 mm, green, densely covered with glandular emergences; hypanthial tube 1.5–4 cm, 4–7 mm wide at base, 6–13 mm wide at apex, green to yellowish green; perianth lobes yellowish green and purple-tinged to pinkish green; sepals lanceolate to ovate-lanceolate, 15–23 × 5–7 mm, mucronate, abaxial surface sparsely covered with small to sessile glandular emergences, adaxially glabrous; petals ovate-lanceolate to ovate, 13–23 × 7–10 mm, apex obtuse, glabrous except sometimes for sparsely sessile glandular emergences on central vein on abaxial surface; corona lobes trapezoidal, ca. 3 × 1 mm, slightly bidentate at apex; anthers 9–12 mm, yellow, basifixed, auriculate at base, inserted at middle of corona lobes, connective vinaceous, appendicular at apex; style 3–4.5 cm, white to

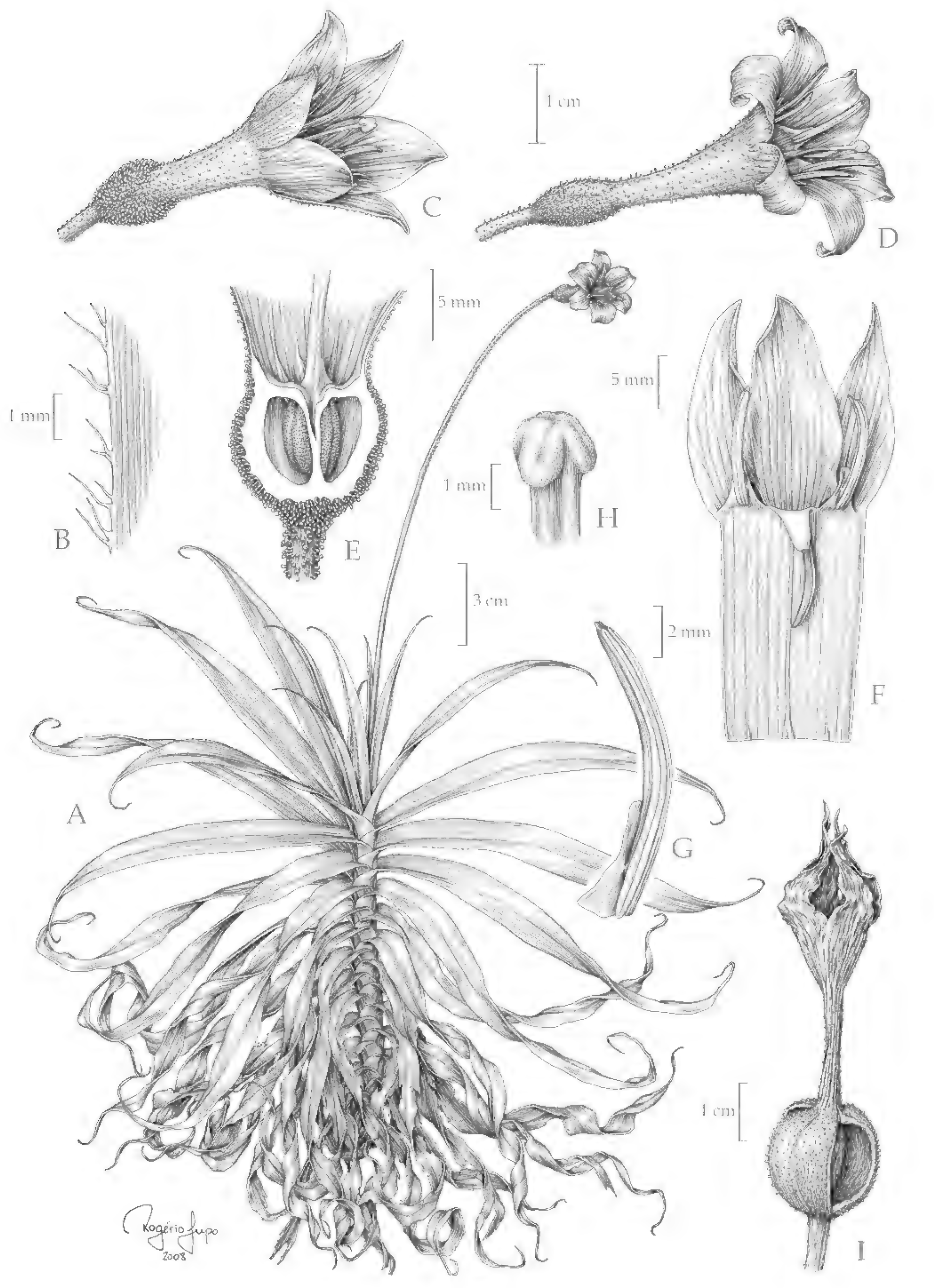


Figure 3. *Barbacenia tuba* Mello-Silva & N. L. Menezes. —A. Habit. —B. Leaf margin. —C. Flower before anthesis. —D. Flower at anthesis. —E. Longitudinal section of proximal region of hypanthium and ovary. —F. Longitudinal section of distal region of hypanthium, showing insertion of corona lobes and perianth. —G. Corona lobe with anther, lateral view. —H. Apex of style with stigmas lobes confluent at apex. —I. Fruit with remnants of hypanthium and perianth. Drawn from the holotype *J. R. Pirani, I. Cordeiro, A. Furlan, J. Semir, N. L. Menezes, A. M. Giulietti & L. Rossi CFCR1666* (SPF).

greenish white, stigma capitate to clavate, 3 lobes confluent at apex, green to yellow. Capsule loculicidal, ca. 2 × 1.7 cm; seeds pyramidal, ca. 1.5 mm long, dark castaneous.

*Leaf anatomy (*from the type *Pirani et al. CFCR1666).* Blades inconspicuously dorsiventral; cuticle thickened on both surfaces; stomata present on abaxial surface only between fibro-vascular bundles; epidermis uniseriate; spongy parenchyma near fibro-vascular bundles and aquiferous parenchyma occupying almost all of the space between bundles; fibro-vascular bundles surrounded by a distinct bundle sheath, 1 (or 2) large vessels present in each fibro-vascular bundle; phloem strands 2, separated by parenchymatous or sclerified cells; fibers extending as girders to epidermis on both sides, adaxial girder much larger than abaxial, widely obtrapeziform to obtriangular in outline.

Etymology. The epithet for the new species is to be regarded as a Latinized noun in apposition, with the hypanthial tube the basis for the epithet.

Distribution and habitat. *Barbacenia tuba* occurs in the Espinhaço Range of the Brazilian state of Bahia, from Mucugê, Andaraí, and Piatã in the south to Morro do Chapéu in the north. It presents a relatively wide distribution among species of the Velloziaceae. Collection sites for the new species range from recorded elevations of 700–1260 m. The new species is distinguished by the long, widely opened and tubular, mostly green-yellow flowers. *Barbacenia tuba* prefers proximity to small rivers and waterfalls, with the stems sometimes hanging down from crevices. Flowering and fruiting take place from September to April (i.e., the rainy season).

IUCN Red List category. *Barbacenia tuba* is well spread in the Chapada Diamantina, from Barra da Estiva in the south to Morro do Chapéu in the north, with populations over non-utilizable grounds. Thus its conservation status would probably be Least Concern (LC), according to IUCN (2001) criteria.

Discussion. *Barbacenia tuba* also resembles, in habit and habitat, *B. graminifolia* and *B. plantaginea*, both from the central part of the Espinhaço Range in Minas Gerais. These taxa share serrulate leaf margins and blade midribs, flowers with long hypanthia on elongate peduncles, and an ecological preference for proximity to water streams or humid, rocky places. The latter two species present reddish flowers, with a smooth hypanthium in *B. plantaginea* and eglandular emergences in *B. graminifolia*. In contrast, *B. tuba* has a green, yellowish green to yellow hypanthium, yellowish green to pinkish tepals, and glandular flower emergences. Additionally, *B. tuba* presents a combination of characters that distinguishes the taxon from all other *Barbacenia*. Its tristichous phyllotaxis, serrulate leaf margins and midrib, and the basifixed, articulate anthers would fit *Pleurostima* sensu Menezes (1980a, 1980b), but the long hypanthium, short apical and confluent stigma lobes, and loculicidal capsules with perianth remnants would correspond to those seen in *Aylthonia* (Menezes, 1971, 1980a, 1980b). Thus, as with the other new species here described, the combination of characters that distinguishes *B. tuba* confirms the observations of Mello-Silva (2005) and Mello-Silva et al. (2011) that *Aylthonia* and *Pleurostima* can no longer be considered.

Paratypes. BRAZIL. **Bahia:** Mun. Barra da Estiva, Serra do Sincorá, Camulengo, 12 Jan. 1987 (fl.), *E. L. M. Catharino 1051* (SP); Mun. Lençóis, Chapadinha, Mata do Grotão, rio Água Doce, próx. a cachoeira, 12°27′01″S, 41°25′03″W, 26 Apr. 1995 (fl., fr.), *A. Pereira, J. Costa & M. C. Ferreira PDC1840* (ALCB not seen, HUEFS, not seen, K not seen, SPF [2]); Cachoeira do Brejão, 19 Feb. 2006 (fl., fr.), *A. A. Conceição 1730* (HUEFS, SPF); Parque Nac. Chapada Diamantina, trilha para a Cachoeira do Sossego, 12°34′S, 41°23′W, 31 Jan. 2010 (fl.), *A. A. Conceição 3291* (HUEFS, SPF); Mun. Morro do Chapéu, 1914 (fl.), *P. Luetzelburg 455* (M); Mun. Mucugê, by Rio Cumbuca, ca. 3 km N of Mucugê on rd. to Andaraí, 12°59′S, 41°21′W, 15 Feb. 1977 (fl., fr.), *R. M. Harley, S. J. Mayo, R. M. Storr, T. S. Santos & R. S. Pinheiro 18700* (CEPEC not seen, HUEFS, K, SPF, US); estrada nova Andaraí-Mucugê, entre 11–13 km de Mucugê, 8 Sep. 1981 (fl., fr.), *A. Furlan, J. R. Pirani, M. L. Kawasaki, J. D. Oliveira, M. C. E. Amaral & N. M. Castro CFCR2137* (K not seen, SPF); rodovia para Andaraí, 17 Sep. 1984 (fl.), *G. G. Hatschbach 48326* (MBM not seen, SPF); Serra do Gobira, encosta, 24 Jan. 2000 (fl.), *L. P. Queiroz, L. F. P. Gusmão & B. M. Silva 5639* (HUEFS); Serra do Gobira, cume, 15 Feb. 2002 (fl.), *R. M. Harley & A. M. Giulietti 54491* (HUEFS); descida do Gobira, 4 Aug. 2004 (fl.), *E. L. Borba, A. C. S. Pereira, P. L. Ribeiro & O. A. Oliveira 1860* (HUEFS); Mun. Palmeiras, Cachoeira da Fumaça, na beira da cachoeira, 1 Feb. 1997 (fl.), *A. A. Conceição & A. Grillo 345* (SPF), 24 Mar. 1997 (fl.), *A. A. Conceição & A. Grillo 467* (SPF); em baixo da Cachoeira da Fumaça, 6 Apr. 1997 (fl.), *A. A. Conceição, A. Grillo & J. Batista 511* (SPF); Cachoeira da Fumaça, 26 Dec. 1999 (fl.), *A. A. Conceição 671* (SPF); Mun. Piatã (Bom Jesus do Rio de Contas), 1914 (fl.), *P. Luetzelburg 467* (M).

4. Barbacenia vellozioides Mello-Silva, sp. nov. TYPE: Brazil. Bahia: Mun. Abaíra, Ouro Fino (baixo), 13°15′S, 41°54′W, 1600–1700 m, 23 Feb. 1992 (fl., fr.), *B. L. Stannard, T. Laessøe, P. T. Sano & W. Ganev H52148* (holotype, SPF; isotypes, CEPEC not seen, HUEFS not seen, K). Figures 4, 5D.



Figure 4. *Barbacenia vellozioides* Mello-Silva. —A. Habit, showing detail of leaf margin. —B. Flower. —C. Longitudinal section of flower. —D. Apex of style with stigma lobes confluent at apex and three lateral stigmatiferous regions —E. Fruit with remnants of perianth. Drawn from the holotype *B. L. Stannard, T. Laessøe, P. T. Sano & W. Ganev H52148* (SPF).

Aspectu et floribus violaceis *Barbaceniae fulvae* Goethart & Henrard maxime affinis, sed ab ea habitu plerunque minore, foliis arcuatis et emergentiis hypanthii glandulosis diagnoscitur; etiam distributione geographica disjuncta differunt.

Caespitose or not; stems 2–30 cm, 1.5–10 cm wide at apex. Leaves tristichous; leaf sheaths dark purple, whitish at base, hidden; leaf lamina arcuate, older ones marcescent, reflexed, 5–35 cm × 5–18 mm, linear-triangular, long attenuate, long to short ciliate on margins and on midrib on abaxial side, sometimes sparsely hirsutulous on abaxial surface, rarely also on the adaxial surface, trichomes longer toward lamina base. Flowers 1 to 3; pedicels 0.5–8 cm, circular in transverse section, violaceous, smooth to densely covered with subulate eglandular whitish emergences toward apex; hypanthium 5–15 mm, terete-obovoid to campanulate, sparsely to densely covered with glandular emergences; whitish, yellowish to greenish, section fused to ovary, 3–10 × 2–7 mm, hypanthial

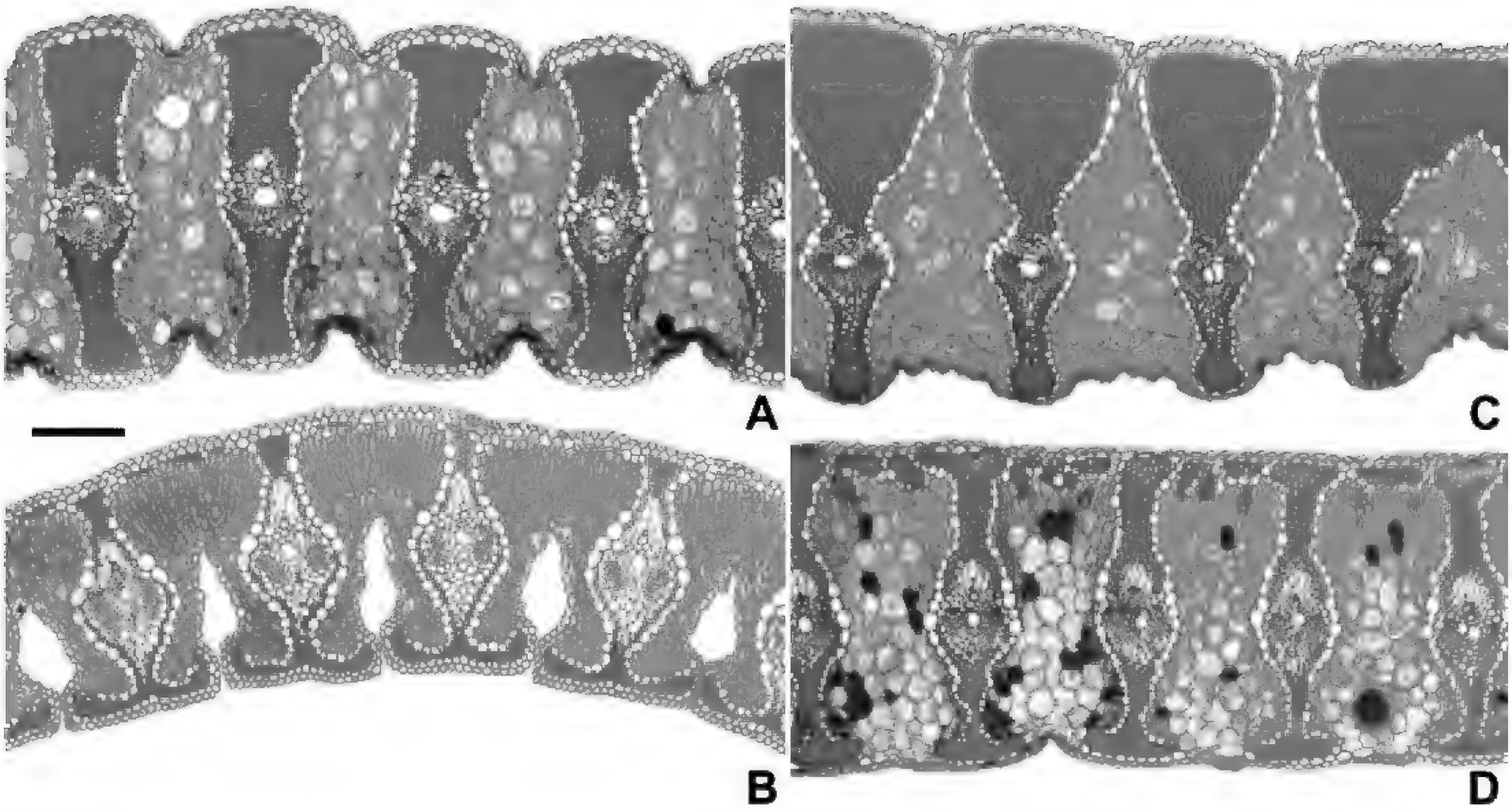


Figure 5. Cross section of median region of lamina. —A. *Barbacenia piranga*, from the type *T. Laessøe, W. Ganev & T. R. S. Silva H53332*. —B. *Barbacenia serracabralea*, from the type *R. Mello-Silva, J. R. Pirani, M. F. A. Calió, K. B. Lepis, R. Riina & J. Lovo 2505* (SPF). —C. *Barbacenia tuba*, from the type *J. R. Pirani, I. Cordeiro, A. Furlan, J. Semir, N. L. Menezes, A. M. Giulietti & L. Rossi CFCR1666* (SPF). —D. *Barbacenia vellozioides*, from the type *B. L. Stannard, T. Laessøe, P. T. Sano & W. Ganev H52148* (SPF). Scale bar = 0.1 mm.

tube 2–5 × 3–8 mm; perianth oblong to lanceolate, 15–40 × 3–6 mm, violet; sepals slightly narrower, sparsely covered with small to sessile glandular emergences on abaxial side, adaxially glabrous; petals smooth except for sparsely sessile glandular emergences on central vein on abaxial side; corona lobes oblong, 15–27 × 1.5–3 mm, violet, deeply bidentate at apex, lobules narrowly triangular, 5–12 mm; anthers 6–15 mm, yellow, basifixed, auriculate at base, slightly appendicular at apex, inserted at base of corona lobes; style 8–20 mm, clavate, violaceous, stigma lobes confluent at apex, whitish, stigmatiferous regions 3 in middle of style, ellipsoid. Capsule 7–15 × 7–15 mm, globose, dehiscent by 3 apical pores; seeds reniform, ca. 1.2 mm, alveolate, blackish in color.

*Leaf anatomy (*from the type *Stannard et al. H52148).* Blades inconspicuously dorsiventral; cuticle thickened on both surfaces; stomata present on abaxial surface only, between fibro-vascular bundles; epidermis uniseriate; adaxial hypodermis 1- to 3-seriate, with bundles of sclerified cells; palisade mesophyll 1 cell-layer thick, grading into spongy parenchyma near fibro-vascular bundles and into aquiferous parenchyma in region between bundles; fibro-vascular bundles surrounded by a distinct bundle sheath, 1 or 2(3) large vessels present in each fibro-vascular bundle; phloem strands 2, separated by parenchymatous or sclerified cells; fibers extending as girders, adaxially to hypodermis, sometimes with lateral extensions merged with bundles of sclerified cells, and abaxially as inverted Y-shaped girders extending along abaxial surface on both sides.

Distribution and habitat. *Barbacenia vellozioides* is endemic to the mountains of Abaíra, around Pico do Barbado, the highest point of the Espinhaço Range in Bahia (Jesus et al., 1985). Collections of the new species were recorded from elevations of 930–1700 m.

IUCN Red List category. Although restricted to the Abaíra region, in Pico do Barbado slopes, *Barbacenia vellozioides* is represented by numerous populations, which grow over non-utilizable terrains that are difficult to access. Thus its conservation status would probably be Least Concern (LC), according to IUCN (2001) criteria.

Discussion. Most distinctive of this species, which inhabits sandy soil among rocks, is its violet perianth. Populations of *Barbacenia vellozioides* were observed to be variable, most conspicuously in leaf lamina and emergences of the hypanthium. The collections *Ganev 609* and *Stannard H52148* (type) present leaf lamina ciliate on margins and midrib, with evident pedicellate flowers that have densely capitate-glandular emergences on the hypanthium.

Other collections such as *Ganev 2729*, *2738*, *2739*, and *Stannard et al. 51689* are much smaller plants, with a hirsutulous leaf lamina, very short peduncles hidden by the leaf sheaths, and a hypanthium with sparsely subulate to only slightly capitate-glandular emergences. Collections such as *Ganev 590* and *3258* have intermediate morphologies, with leaf lamina on *590* and with flowers on *3258*. *Barbacenia vellozioides* has been collected with flowers from December to July and just once with fruits, in February.

Barbacenia vellozioides is quite similar in its habit, androecium, and gynoecium to *B. fulva* Goethart & Henrard, also a distinctive species. They share a similar violet perianth, an uncommon color among species of *Barbacenia*. The flowers resemble those seen in species of *Vellozia*, not only in color but also in texture and form. The epithet of the new species acknowledges this similarity in flowers. Otherwise, the basifixed anthers, attached to the hypanthium, and lateral stigma lobes would suggest placement in *Pleurostima*. Nevertheless, contrary to what has been stated for *Pleurostima* (Menezes, 1980a, 1980b; Menezes & Semir, 1991), the capsule of *B. vellozioides* is not dehiscent by many intercostal openings, but by apical pores, like some other species of *Barbacenia* s. str. and many others of *Vellozia*. This characteristic, as in the case of *B. tuba*, renders the taxonomic recognition of *Pleurostima* problematic (Mello-Silva, 2005). *Barbacenia vellozioides* and *B. fulva* differ mainly in leaf posture and hypanthium emergences, which are, respectively, plane and eglandular subulate in *B. fulva*, and arcuate and glandular-capitate, rarely subglandular in *B. vellozioides*. Moreover, these species present a wide distributional disjunction, more than 900 km, with *B. fulva* being endemic to the Serra da Canastra region, in the southwestern Brazilian state of Minas Gerais.

Paratypes. BRAZIL. **Bahia:** Mun. Abaíra, caminho Guarda-Mor e Água Limpa, volteando o Morro do Cuscuz, 25 June 1992 (fl.), *W. Ganev 590* (HUEFS, K not seen, SPF); Garimpo do Bicota, 13°19′S, 41°48′W, 2 Mar. 1992 (fl.), *B. L. Stannard, W. Ganev & R. F. Queiroz 51689* (HUEFS not seen, K not seen, SPF); caminho Betão–Tanque do Boi, 13°16′S, 41°54′W, 4 July 1992 (fl.), *W. Ganev 609* (HUEFS, K not seen, SPF); Cabaceira, Riacho Fundo, atrás da Serra do Bicota, 13°23′S, 41°51′W, 25 Oct. 1993 (fl.), *W. Ganev 2322* (HUEFS); Virassaia, 13°21′S, 41°50′W, 30 Dec. 1993 (fl.), *W. Ganev 2729*, *2738*, *2739* (HUEFS, K not seen, SPF); estrada abandonada Catolés–Arapiranga, entre Riacho Fundo e Riacho Piçarrão, próx. à casa de Osmar Campos, 13°22′S 41°49′W, 13 Apr. 1994 (fl.), *W. Ganev 3258* (HUEFS, K not seen, SPF); caminho Boa Vista–Bicota, 9 Sep. 1995 (fl.), *F. França, E. Melo, L. P. Queiroz & W. Ganev 1294* (HUEFS); alto do Morro da Serrinha, 13°19′S, 41°51′W, 31 May 2003 (fl.), *M. J. G. Andrade, A. A. Conceição & M. Vanilda 347* (HUEFS).

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Dendrocalamus longivaginatus (Poaceae, Bambusoideae), A New Species from Vietnam

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Abstract. A new species of *Dendrocalamus* Nees (Poaceae, Bambusoideae), *D. longivaginatus* N. H. Xia, V. T. Nguyen & V. L. Le, is illustrated and described from Phu Tho, Vietnam. This species is known only from the northern provinces of Vietnam: Phu Tho, Yen Bai, and Ha Giang. It is morphologically similar to *D. brandisii* (Munro) Kurz, a widely distributed bamboo from Thailand, Myanmar, China, and Vietnam, but differs by the ligules of the culm sheath, which are irregularly fimbriate, slightly concave, and 7–9 mm, and by the pseudo-spikelets, which are (5–)13–16 mm with lemmas 9–11.5 mm.

Key words: *Dendrocalamus*, IUCN Red List, Poaceae, Vietnam.

Dendrocalamus Nees was described in 1834 by Nees von Esenbeck based on *D. strictus* (Roxb.) Nees; the genus currently comprises ca. 52 species worldwide (Ohrnberger, 1999). The species occur in tropical and subtropical regions of Asia, from India and Nepal to South China, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, and Papua New Guinea, with the majority found in China, Vietnam, and Malaysia (Munro, 1868; Gamble, 1896; Camus, 1913; Camus & Camus, 1923; Stapleton, 1994; Dransfield & Widjaja, 1995; Hsueh & Li, 1996; Li & Stapleton, 2006; Yi et al., 2008). An initial systematic classification of *Dendrocalamus* was established by Gamble in 1896. For the classification of *Dendrocalamus* in Vietnam, Camus (1913) made the first recordings of three bamboo species of *Dendrocalamus* in Vietnam: *D. latiflorus* Munro, *D. brandisii* (Munro) Kurz, and *D. giganteus* Wall. ex Munro. Nguyen (1989, 1990, 1991) published six new names in *Sinocalamus* McClure, which was reduced to a synonym of *Dendrocalamus* Nees by Chia & Fung (1980). In a preliminary enumeration of the bamboos of Vietnam, there were considered to be 29 species potentially present for this genus in Vietnam, but only 14 of them are formally established with scientific names (Nguyen, 2006).

During studies on *Dendrocalamus* from Vietnam, the authors carried out a survey in northern Vietnam, with specimens of a distinctive bamboo collected in Phu Tho, Yen Bai, and Ha Giang Provinces. This new species of *Dendrocalamus*, locally known as Diễn đá, is characterized by culm internodes and leaf sheaths initially covered with a white powder, and sometimes sparsely with caducous, appressed black hairs; these culms and sheaths are later glabrescent. The culm branching pattern exhibits one dominant branch and horizontal culm leaf blades. After careful examination of the morphological characters, particularly the inflorescence structures, and consultation with the relevant literature (Camus & Camus, 1923; Hsueh & Li, 1988a, 1988b, 1996; Nguyen, 1989, 1990, 1991; Stapleton, 1994; Li & Stapleton, 2006; Nguyen et al., 2011), we conclude that Diễn đá is clearly a member of the genus *Dendrocalamus* on the basis of its reproductive characters of six stamens with free filaments, 1-keeled prophylls, and a very short rachilla with the internodes not disarticulating. The new species is assigned to *Dendrocalamus* subg. *Dendrocalamus* according to recent classification schemes (Hsueh & Li, 1988a, 1988b, 1996) and represents an undescribed species.

Dendrocalamus longivaginatus N. H. Xia, V. T. Nguyen & V. L. Le, sp. nov. TYPE: Vietnam. Phu Tho: Yen Lap Distr., My Luong commune, Vinh Thinh village, 21°29.754′N, 104°56.690′E, 41 m, 11 Apr. 2009, *Van Tho Nguyen NVT 20090411* (holotype, HN; isotypes, IBSC, MO, Vietnamese Academy of Forest Sciences [VAFS], Forest Science Centre for Central Northern Vietnam [VAFS-CH]). Figures 1, 2.

Species nova *Dendrocalamo brandisii* (Munro) Kurz affinis, sed ab eo culmorum vaginis abaxialiter albo-pulvereis trichomatibus nigris adpressis caducis sparsim vestitis, ligula 7–9 mm longa irregulariter fimbriata ac leviter concava, pseudospicula (5–)13–16 mm longa et lemmate 9–11.5 mm longo differt.

Arborescent bamboo; rhizomes pachymorph, short necked; culms erect, 15–18 m tall, 10–12 cm diam., culm apex erect or slightly nodding; culm internodes terete, 25–35 cm; culm wall 1–2.5 cm thick; culm surface initially white powdery and pulverulent, and later glabrate, green with age, both infranode and internode glabrous; branches developing from 10th to 12th node, ca. 3.5–4 m above ground, several at each node, usually only one branch dominant and horizontal. Culm leaves deciduous, blade sheath leathery, longer than associated internode, abaxially white powdery, puberulent, sparsely covered with caducous, appressed black hairs, external sheath surface with evident longitudinal ribbing, margins densely ciliate, but cilia caducous; sheath apex nearly rounded; oral setae absent; auricle small, reflexed, 1–2 mm, 5–10 mm wide, margin fimbriate; ligule 7–9 mm, irregularly fimbriate and slightly concave; leaf blades horizontal, sometimes nearly erect, 1/4 to 1/3 the length of associated sheath, blades adaxially straw-yellow and setose, abaxially yellow-brown and glabrous, both sides with evident longitudinal ribbing, base extended on both sides and joined with auricles, apex acuminate; leaves of terminal branch complement (5 to)8 to 11 per ultimate branch, sheath glabrous; auricles absent; ligules ca. 1 mm truncate, margin puberulent; pseudo-petiole 3–4 mm, pubescent; leaf blades linear to lanceolate, 15–34(–43.5) × 2.3–3.5(–5.9) cm, base cuneate or broadly cuneate, apex narrowly acuminate, adaxially glabrous, abaxially pubescent. Inflorescence a large compound panicle with spicate branchlets bearing heads of pseudo-spikelets; flowering branches without leaves, brown villous, nodes swollen, internodes of secondary flowering branches 2–7.5 cm, with clusters of (3 to)10 to 18(to 30) pseudo-spikelets at each node, but without pseudo-spikelets at terminal node; pseudo-spikelets fusiform, purple-green, usually (5–)13–16 × (2–)3–5 mm; prophyll 1-keeled, keels long ciliate, apex blunt, margin long ciliate; florets (1 to)3 or 4 per pseudospikelet, all florets fertile, each floret closed when mature, rachilla internodes very short and not disarticulating. Glumes 2 or 3, oval, 6–7 × 5.5–6.5 mm long, many-veined, pubescent at upper half, apex blunt, margin ciliate; lemmas ovate, 9–11.5 × 6–7 mm, pubescent, many-veined, apex long mucronate, mucros to 1.7 mm, margin ciliate; palea oblanceolate, 2-keeled, 10–11 × 3–3.5 mm, abaxially glabrous, keels and margins long ciliate, 3-veined between keels, with reticulate cross-venation and without veins on either side of keels, apex bifid or blunt, uppermost palea 2-keeled, 11–12.5 × 3–3.5 mm, apex usually acute; lodicules absent; stamen 6, anthers yellow, 5–6 mm, exserted, apex acuminate, glabrous; filaments free; pistil 6.5–9 mm; ovary globose and ovoid, densely hairy, base with stipe ca. 0.4–0.5 mm; style 5.5–7.5 mm, densely hairy; stigma 1, hairy. Fruit unknown.

Etymology. The specific epithet of *Dendrocalamus longivaginatus* refers to the long culm sheaths that are longer than their associated internodes as well as the long leaf sheaths of the foliage on branch complements.

Phenology. Flowering material was collected in April. Similar to other woody bamboos in the area, the entire bamboo clump continued to flower for one to two years, followed by the death of the clump.

Distribution and ecology. The natural habit of *Dendrocalamus longivaginatus* is along the edge of evergreen broad-leaved tropical forest. It is also commonly found in degraded natural forest and has been cultivated in household gardens, at elevations of 50–100 m, in northern Vietnam, in Phu Tho, Ha Giang, and Yen Bai Provinces. Flowering material was taken from a cultivated clump in Vinh Thinh village, My Luong commune, Yen Lap District, Phu Tho Province. Additional material was collected from the Cau Hai bamboo garden, Chan Mong commune, Doan Hung District, Phu Tho Province. No fruit was seen at any collection site. The bamboo vegetative shoots emerge from July to September.

IUCN Red List category. *Dendrocalamus longivaginatus* should be considered as Vulnerable (VU), according to IUCN Red List criteria (IUCN, 2012). *Dendrocalamus longivaginatus* was only found as several clumps under cultivation in Phu Tho, Yen Bai, and Ha Giang Provinces, and the total known

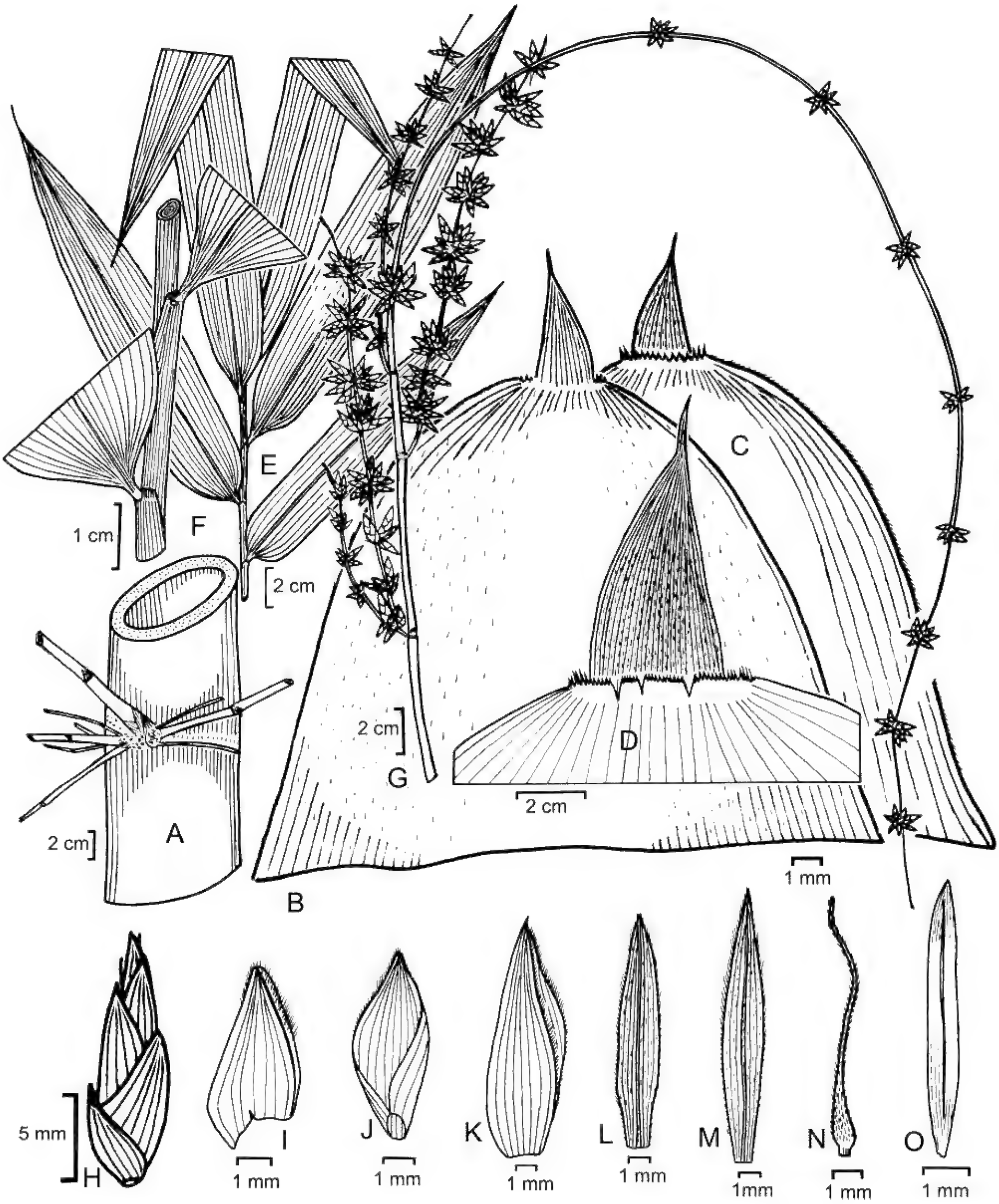


Figure 1. *Dendrocalamus longivaginatus* N. H. Xia, V. T. Nguyen & V. L. Le. —A. Culm and branch. —B. Culm sheath (abaxial view). —C. Culm sheath (adaxial view). —D. Culm sheath ligule. —E. Foliage leaf. —F. Foliage leaf ligule. —G. Flowering branch. —H. Pseudo-spikelet. —I. Prophyll. —J. Glume. —K. Lemma. —L. Palea. —M. Uppermost palea. —N. Pistil. —O. Anther. Drawn from the type *V. T. Nguyen NVT20090411* and paratype *V. T. Nguyen NVT001*.

population size is fewer than 10,000 mature individuals. Moreover, the area is less than 20,000 km^2 for extent of occurrence (EO), and 2,000 km^2 for area of occurrence (AOO). *Dendrocalamus longivaginatus* is known to exist at no more than 10 locations.

The new species is economically valuable to the local people. Its shoots are slightly bitter and can be used for food. The culms are rigid, often used for house construction and general household use, and as raw material for paper making.

Discussion. *Dendrocalamus longivaginatus* is similar to *D. brandisii* in its general appearance as tall bamboos with pachymorph rhizomes and erect culms 15–18 m. The new species is distinguished by its culm internodes that are white powdery, by the culm sheaths that are white powdery and sparsely covered with caducous, appressed black hairs (vs.

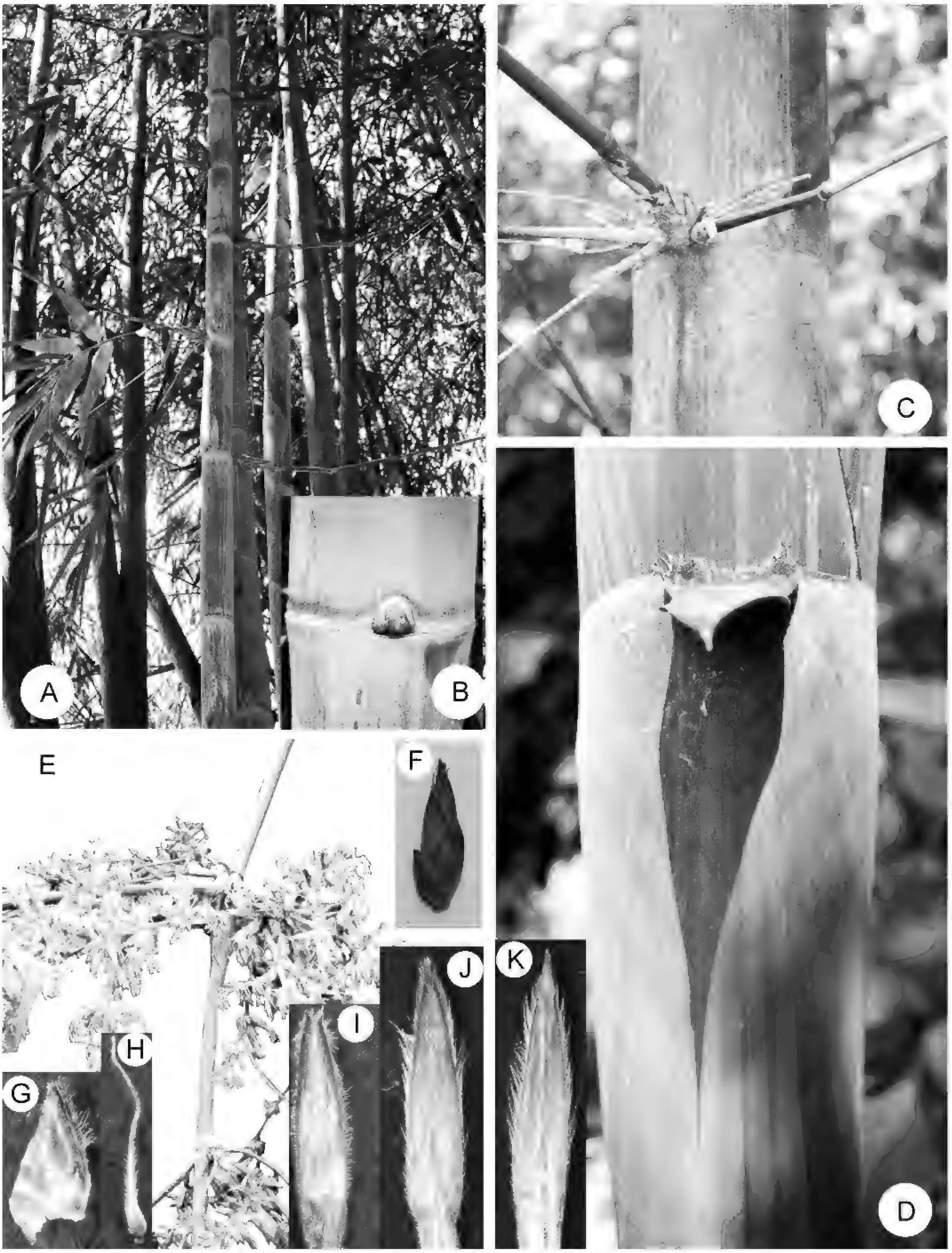


Figure 2. *Dendrocalamus longivaginatus* N. H. Xia, V. T. Nguyen, & V. L. Le. —A. Clump. —B. Dormant bud. —C. Branch. —D. Culm sheath. —E. Flowering branch. —F. Pseudo-spikelet. —G. Prophyll. —H. Pistil. —I, J. Lemma. —K. Uppermost palea. Photos by V. T. Nguyen. A–D taken at the Cau Hai bamboo garden, Doan Hung District, in Phu Tho Province, Vietnam; E–K taken at the type locality, Phu Tho, Yen Lap District, My Luong commune, Vinh Thinh village.

white pubescent in *D. brandisii*), by the pseudo-spikelets (5–)13–16 mm (vs. 7–9 mm long), lemmas 9–11.5 mm (vs. 5–6 mm) and anthers 5–6 mm (vs. 3 mm).

Paratypes. VIETNAM. **Ha Giang:** Quan Ba Distr., Quan Ba, *Van Tho Nguyen NVT 286* (IBSC, VAFS); Hoang Su Phi Distr., Ho Thau commune, *Van Tho Nguyen NVT 287* (IBSC, VAFS). **Phu Tho:** Doan Hung Distr., Chan

Mong commune, cult. in Cau Hai bamboo garden, 21°31.897′N, 105°11.917′E, 50 m, 1 Aug. 2010, *Van Tho Nguyen NVT 001* (IBSC, MO, VAFS, VAFS-CH); *Nguyen Tu Uong & Le Viet Lam 69* (VAFS). **Yen Bai:** Tran Yen Distr., Luong Thinh commune, cult. *Van Tho Nguyen NVT 093* (IBSC, VAFS).

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Four New Species and Two New Sections of *Camellia* (Theaceae) from Vietnam

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Abstract. Four new species of *Camellia* L. (Theaceae) are described from Vietnam: *C. duyana* Orel, Curry & Luu, *C. ligustrina* Orel, Curry & Luu, *C. bugiamapensis* Orel, Curry, Luu & Q. D. Nguyen, and *C. capitata* Orel, Curry & Luu. The new taxa were collected from the Da Lat Plateau and the Lang Biang Massif phytogeographic region in southern Vietnam. The new finds are morphologically dissimilar to known *Camellia* species, and for two species, the new sections *Camellia* sect. *Capitatae* Orel and *Camellia* sect. *Pierrea* Orel are established. These species are endemic to the montane temperate or to the lowland tropical rainforests of Vietnam.

Key words: *Camellia*, IUCN Red List, Theaceae, Vietnam.

About 80% of all *Camellia* L. species are found in China, and most of the remainder occur within the territory of Vietnam. Traditionally, it was believed that there were ca. 26 *Camellia* species endemic to Vietnam, with 17 other species shared among Vietnam, China, Laos, and Myanmar (Burma) (Tran, 2002). However, recent vegetation surveys have led to new discoveries in the Tam Dao National Park and adjacent geographic areas, as well as on Da Lat Plateau and Lang Biang Massif. This has resulted in an increase in the number of known indigenous Vietnamese *Camellia* species (Orel, 2006; Orel & Wilson, 2010a, 2010b, 2012; Orel et al., 2012). Further discoveries have been made in these geographic areas, including the four new species and the delimitation of two new sections within the genus established here. In assessing the new taxa, we consulted the taxonomic works of Sealy (1958), Chang and Bartholomew (1984), Ho (1991), Gao et al. (2005), and Ming and Bartholomew (2007). However, it should be pointed out that current taxonomic treatments of sections, and their contents in terms of species, tend to differ from author to author. Therefore, we drew data from these four currently used taxonomic systems to decide the basis of our taxonomic classification of the new species presented here. The taxonomic system of Sealy (1958) is considered to be the most detailed and thorough study of the genus *Camellia* currently available, and, along with Chang and Bartholomew (1984), it forms the basis upon which rests our current understanding of the genus. The taxonomic systems of Gao et al. (2005) and Ming and Bartholomew (2007) were used for supplementary data only, as these systems are deemed to be derived from, but inferior to, the system of Sealy (1958). As this paper is intended only to describe several new *Camellia* species, discussion of *Camellia* sections are kept to a minimum. To include an in-depth discussion of sectional relationships in the genus *Camellia* would indeed require a much larger, separate paper, so we have not undertaken a detailed consideration of the sectional treatment of individual *Camellia* species by different authors here.

Each of the four new species is described below, including placement according to our assessment of their position relative to the sectional scheme of Sealy (1958). Two species are referred to new sections owing to their unique combinations of characters that differentiate them from all currently named sections. Leaf venation terminology is based on Hickey (1979), and perule features are well illustrated by Gao et al. (2005).

I. *Camellia* sect. *Heterogeneae* Sealy

Flowers sessile or subsessile, solitary or paired; perules imbricate and forming an involucre, persistent or deciduous; stamens united with petals at base but otherwise free, glabrous; ovaries mostly tomentose; styles 3 to 5, free or united.

Key to Vietnamese Species of *Camellia* sect. *Heterogeneae*

1a. All stamens free to the base.
  2a. Petals 5 ..... *C. fleuryi* (A. Chev.) Sealy

2b. Petals 8 or 9 ..... *C. gaudichaudii* (Gagnep.) Sealy

1b. Outer stamens united for 2–6 mm at base.

3a. Petals 8; filaments fused to petals for 4 mm ..... *C. furfuracea* (Merr.) Cohen-Stuart

3b. Petals 5 to 8; filaments fused to petals for <2 mm ..... *C. duyana*

1. Camellia duyana Orel, Curry & Luu, sp. nov. TYPE: Vietnam. Lam Dong: ca. 40 m below ridge of unnamed mtn. on Da Lat Plateau, ca. 1400 m, 27 Nov. 2010 (fl.), *G. Orel & Nguyen Van Duy 0719* (holotype, NSW; isotype, SGN). Figure 1.

Species nova *Camelliae henryanae* Cohen-Stuart, typo sectionis *Heterogenearum* Sealy, affinis, sed ab ea foliis ellipticis vel anguste ellipticis, floribus majoribus sessilibus, petalis 5 ad 8, androecio ad corollam minus adnato et staminibus externis minus connatis differt.

Perennial, medium to large evergreen shrub, 12–15 m high, with upright habit, well branched, usually multi-stemmed; the main stem to 50 cm thick at base; secondary branches heavy and ascending at ca. 45°; mature bark smooth, with dull sheen, reddish to light cinnamon, usually with heavy lichen growth; new shoots thin, reddish brown, glabrous, shiny, turning reddish gray on semi-mature branches; mature branches concolorous to trunk. Petioles linear to slightly falcate, proximally slightly twisted around its longitudinal axis, light green abaxially, 0.7–1.1 cm × 1.5–2.5 mm, mid-green adaxially, with a light brown, shallow, sometimes corky, 1–1.5 mm wide, and ca. 1 mm deep channel; axillary leaf buds small, rudimentary, laterally compressed, <1 mm diam., green to dark brown; terminal leaf buds mid-green, with unevenly distributed purplish areas; scale margins hairy, slightly falcate, with sharp apex, 4.5–5 × 1–2(–2.5) cm; developing leaves light green, with distinct sheen, glabrous, coriaceous, narrowly elliptic, distally irregularly serrate, less so proximally, with margins slightly undulate distally; mature leaves narrow elliptic to elliptic, glabrous, slightly coriaceous, 10–13.5(–14.5) × 3.9–4.7(–5) cm, irregularly and finely serrate, more so distally, with margins undulate; adaxial surface mid-green, shiny, lighter green and shiny below; leaf apex variable, cuspidate; leaf base variably acute to cuneate; midrib narrowly sunken adaxially, prominent abaxially, 1.5–2.5 mm wide proximally, <1 mm wide distally, light green, dull, with occasional brownish areas on both sides; secondary venation pinnate, distinctly brochidodromous (Hickey, 1979), with 9 to 12 pairs of veins, adaxially sunken, abaxially slightly prominent; tertiary venation indistinct, rather sparse, unevenly distributed, adaxially sunken, more prominent at leaf margins, abaxially almost invisible to slightly prominent; areolation well developed only toward leaf margins, with meshes unevenly tetragonal to hexagonal, of relatively inconstant size; maximum areole dimensions 0.7 × 3 mm, with areole size decreasing toward leaf margins. Flowers sessile, terminal and axillary, mostly solitary, lacking scent; senescing flowers with reflexed petals and large, distinct perules; flower buds numerous, orbicular, horizontal or upright, mostly green but whitish toward distal end; flowers 6.5–7.5(–8) cm diam., white to off-white, soft, crinkly, opaque to translucent toward margins, thicker toward center; petals 5 to 8, arranged in 2 whorls, reflexed in mature flowers, glabrous, sometimes emarginate, overlapping proximally, lacking midrib but with visible, fanlike longitudinal striations that are concolorous and abaxially slightly raised; petals of outer whorl 3 to five, 3–3.5 × 1.8–2.5 cm, slightly concave, sometimes asymmetric, elliptic to obovate in shape, proximally fused for 4–6 mm to each other, otherwise free; petals of inner whorl 2 to 3, relatively variable in size, 3–3.3 × 1.5–2.5 cm, slightly concave, slightly asymmetric, narrowly elliptic to distinctly obovate, basally attached to stamens for 2–3 mm; perules undifferentiated, arranged in 3 loose and uneven whorls of 3 perules each; perules of outer whorl unevenly orbicular, slightly emarginate, of slightly varying sizes, concave, sometimes proximally overlapping, hairy on both surfaces, mostly brown, with some green areas randomly distributed, with keel and striations lacking, to 4 × 6–7 mm, with margins becoming frayed, persistent on newly opened flowers, deciduous shortly after; perules in middle whorl unevenly orbicular to ovate, distinctly emarginate, of slightly varying lengths, concave, proximally overlapping, rigid, finely tomentose, not entirely woody, dark brown, with a horizontally oriented line of lighter discoloration, 8–9 × 12–14 mm, persistent on newly opened flowers, deciduous shortly after; perules in inner whorl unevenly ovate to elliptic, concave, proximally overlapping, rigid, but not entirely woody, hairy, dark to mid-brown, with margins translucent and wavy, to 15 × 18–20 mm, persistent on newly opened flowers, deciduous shortly after; stamens fewer than 50, glabrous, yellow, in a circular series 2.5–3 cm diam.; filaments yellow, thin, 8–16 mm, almost free, basally fused for 2–3 mm, partially proximally joined to inner petal whorl; anthers very small, indistinct, ≤1 mm in diam., dark yellow, later brown, dorsifixed, although some stamens appear to be basifixed; styles 3(to 4), 10–12 × (1–)2–3 mm, less wide distally, free to base, finely tomentose, whitish yellow; stigma brown to dark brown, almost black, indistinct; ovary superior,

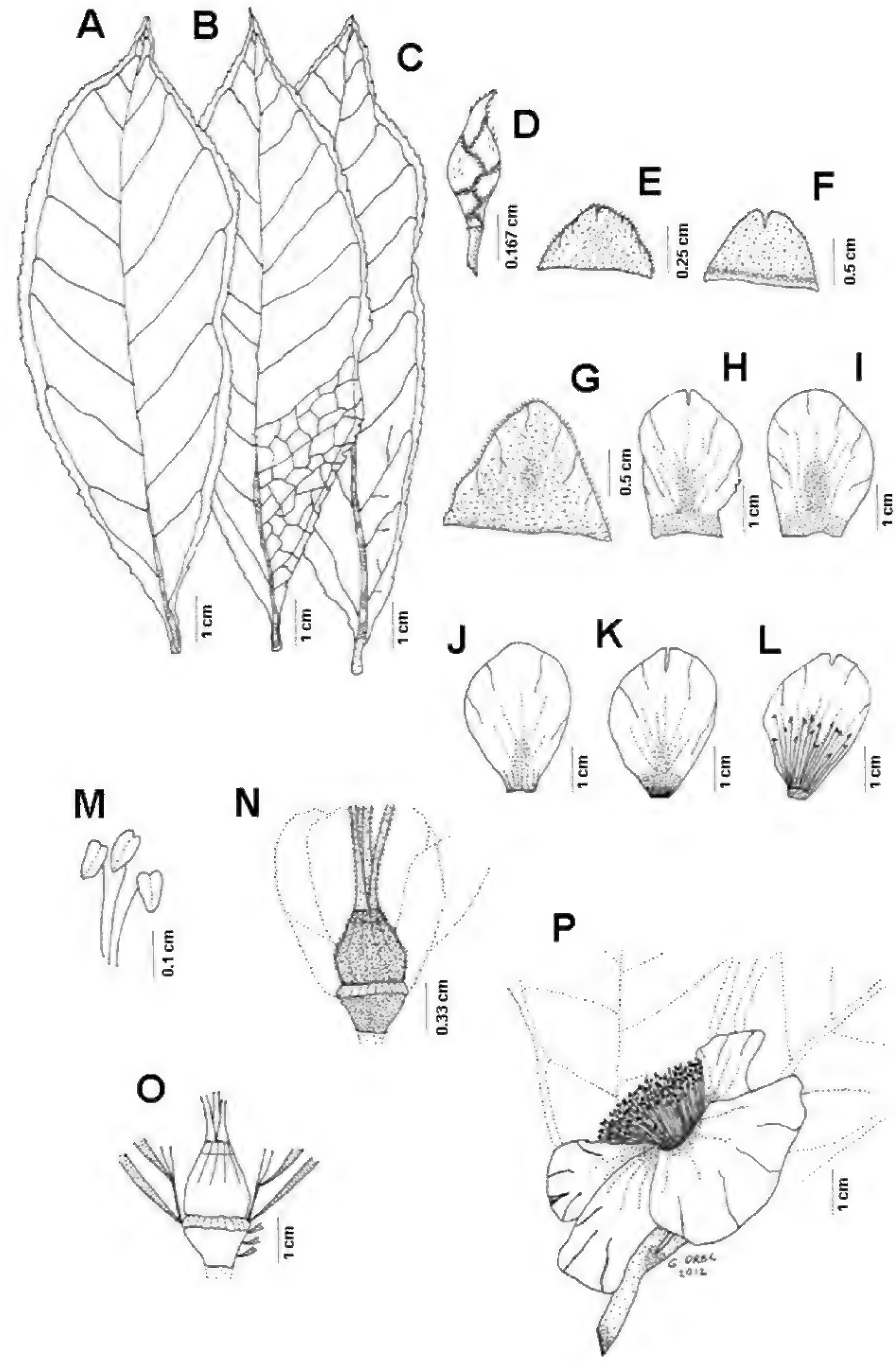


Figure 1. *Camellia duyana* Orel, Curry & Luu. —A. Adult leaf, primary and secondary venation, adaxial view. —B. Adult leaf, primary, secondary, and tertiary venation, adaxial view. —C. Adult leaf, primary, secondary, and tertiary venation, abaxial view. —D. Terminal leaf bud. —E. Perules, outer whorl. —F. Perules, middle whorl. —G. Perules, inner whorl. —H, I. Petals, outer whorl. —J, K. Petals, inner whorl. —L. Corolla and part of androecium. —M. Stamens. —N. Adult gynoecium. —O. Lateral view of mature flower, schematic diagram. —P. Branch with flowers and leaves. Drawn from the holotype *G. Orel & Nguyen Van Duy 0719* (NSW, SGN).

almost diamond-shaped, (3-) 4- or 5-carpellate, finely and densely yellowish tomentose, with fine longitudinal striations proximally, 2.5–3.5 × 4–5 mm. Immature fruit unevenly globose to elliptical; mature fruits and seeds not seen.

Distribution and ecology. *Camellia duyana* is known only from the type location, in Lam Dong Province, some 40 m below the ridge of an unnamed mountain on Da Lat Plateau. This new species occurs as part of dense understory vegetation situated in a less dense area of rainforest, with filtered sunlight reaching the ground during the midday hours. The species seems to thrive in poor, wet, but well-drained soils. It may be pollinated by bees (so far unidentified), as a small number of these insects were observed in the vicinity.

IUCN Red List category. The current area of occupancy (AOO) for this species is estimated to be less than 1 km^2. Despite a further search (in 2011) of the area around the type locality, only two additional mature plants were located. The site is not within any national park or reserve and is subject to logging and other human disturbance. Given this situation, we consider the IUCN category of Critically Endangered (CR) to be appropriate under criterion D and possibly E (IUCN, 2011). The first author was unable to find another specimen of *Camellia duyana* in any Vietnamese herbarium.

Phenology. *Camellia duyana* was collected in flower in late November. The relatively large number of almost mature flower buds at the time of collection may indicate that December to January is the main flowering period for this species. No mature fruits or seeds were found.

Etymology. The specific epithet honors Mr. Nguyen Van Duy, a member of the Lam Dong Provincial Council and the co-discoverer of this new species.

Discussion. The newly proposed species, *Camellia duyana*, was found outside of, but close to, the geographical area considered by Sealy (1958: fig. 3) to be the natural range of species in his *Camellia* sect. *Heterogeneae* (see also Gao et al., 2005). Although *C. duyana* shares a number of morphological characteristics with species belonging to *Camellia* sect. *Camellia* (L.) Dyer, *Camellia* sect. *Pseudocamellia* Sealy, and *Camellia* sect. *Paracamellia* Sealy, these are rather superficial. Dissimilarity in the mode of stamen attachment (free above a shortly fused base) justifies the exclusion of *C. duyana* from the abovementioned sections and supports placement into *Camellia* sect. *Heterogeneae* (Sealy, 1958).

II. Camellia L. sect. **Pierrea** Orel, sect. nov. TYPE: *Camellia ligustrina* Orel, Curry & Luu.

Haec sectio ab aliis sectionibus *Camelliae* L. staminibus externis loratis antheris minimis, stylo sinuato, fructu irregulariter globoso et seminibus subtiliter pubescentibus differt.

Leaves narrow elliptic to elliptic; flowers sessile to almost sessile, with 6 to 10 undifferentiated perules loosely arranged in 2 whorls; petals 5, also in 2 whorls; stamens not numerous, outer stamens straplike, basally fused; anthers small, distinct, when mature covered by an abundance of pollen grains; style hairy, single, sinuous, and columnar; ovary 3(4)-carpellate, almost conical, tomentose; style single, sinuous, and columnar, hairy; mature fruit unevenly globose-elliptical, densely hairy, 3-valved; seed light brown, unevenly and finely hairy.

Discussion. *Camellia* sect. *Pierrea* is characterized by straplike outer stamens, exceptionally small anthers, a sinuous style, unevenly globose-elliptical fruit, and finely hairy seeds. The epithet for the new section, *Pierrea*, honors the famous French botanist and explorer Jean Baptiste Louis Pierre (1833–1905), the former founder and director of the Saigon Zoo and Botanical Gardens in Vietnam.

1. Camellia ligustrina Orel, Curry & Luu, sp. nov. TYPE: Vietnam. Lam Dong: Mt. Lang Biang, 1850 m, 16 Dec. 2011 (fl., fr.), *G. Orel & A. Curry 0734* (holotype, NSW; isotype, SGN). Figure 2.

Ab aliis speciebus *Camelliae* L. foliis anguste ellipticis vel ellipticis, floribus sessilibus vel subsessilibus, perulis 6 ad 10, petalis 5 et ovario 3(4)-loculari distinguitur.

Perennial, small to medium evergreen shrub, 4–6 m high, with upright habit, well branched, almost always multi-stemmed; main stem to 25 cm thick at base; secondary branches thin and ascending at ca. 45°; mature bark generally smooth, rougher toward stem bases, with dull sheen, unevenly blotched, reddish to light cinnamon to light brown; new shoots thin, reddish purple to brown, finely tomentose, with short white hairs; older branches light gray and finely tomentose; mature branches glabrous, reddish to light cinnamon to light brown. Petioles short, 0.3–0.5 cm × 1–2(–3) mm, mostly linear, sometimes slightly falcate, slightly wider distally, finely tomentose, light to mid-brown abaxially, mid-green to brown adaxially, with a light brown, shallow, longitudinal

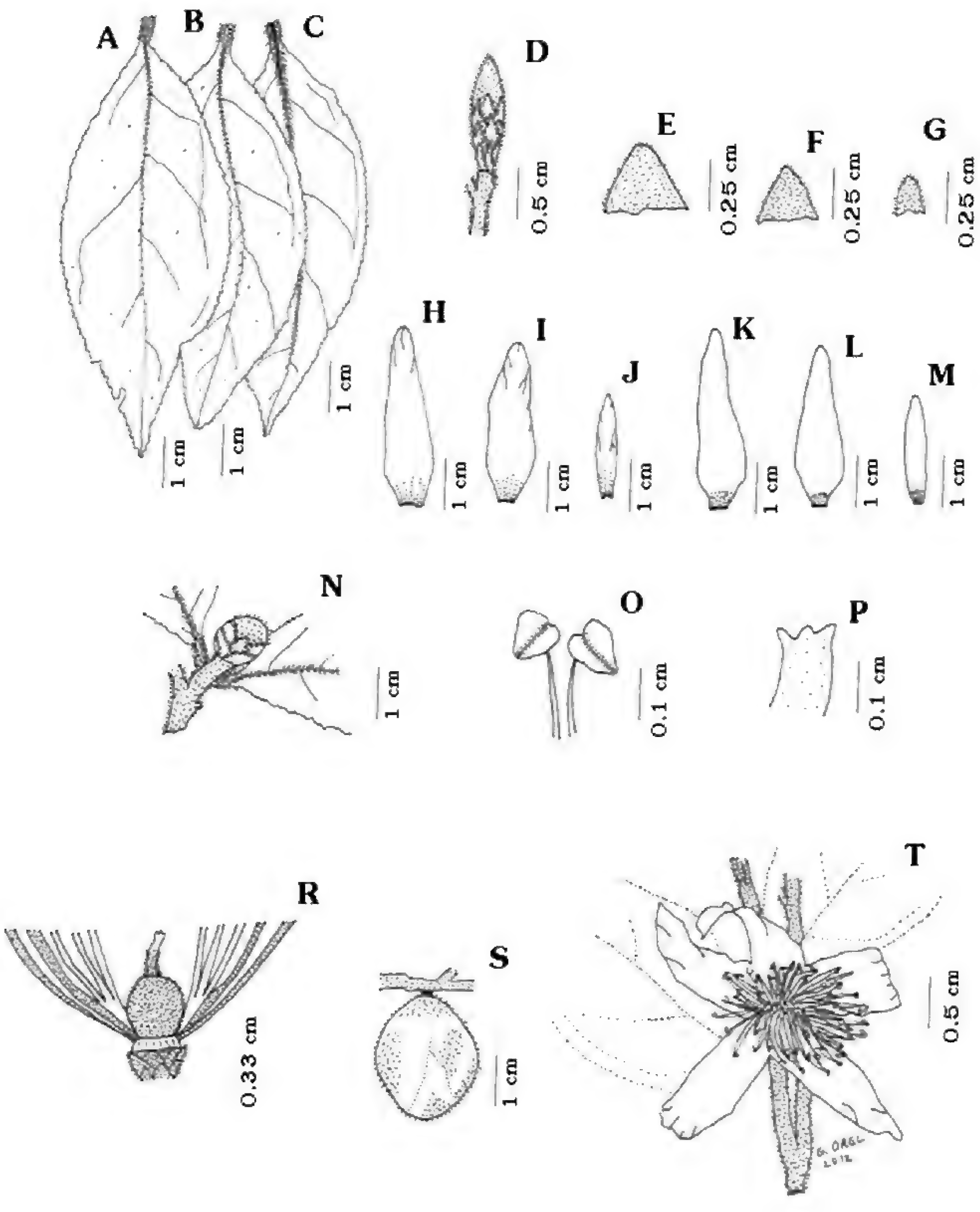


Figure 2. *Camellia ligustrina* Orel, Curry & Luu. —A. Adult leaf, primary and secondary venation, adaxial view. —B. Adult leaf, primary and secondary venation, shape variation, adaxial view. —C. Adult leaf, primary and secondary venation, abaxial view. —D. Terminal leaf bud. —E. Undifferentiated perules, distal whorl. —F, G. Undifferentiated perules, proximal whorl. —H–J. Petals, outer whorl. —K–M. Petals, inner whorl. —N. Developing flower bud. —O. Anthers. —P. The apex of the style. —R. Lateral view of mature flower, schematic diagram. —S. Adult fruit capsule. —T. Branch with flowers and leaves. Drawn from the holotype *G. Orel & A. Curry 0734* (NSW, SGN).

channel ca. 1 mm wide, <1 mm deep; dormant axillary leaf buds small, rudimentary, laterally compressed, sometimes slightly falcate, finely hairy, 2–3 × 1–1.5(–2) mm, dark brown; terminal leaf buds light to mid-green, later brown to dark brown, hairy, short and slightly flattened, with sharp apex, 0.8–1(–1.3) × 3–4 mm, with scale margins also hairy; developing leaves light green, with distinct sheen, glabrous, narrowly elliptic to elliptic oval, distally regularly serrate, less so proximally; mature leaves narrowly elliptic to elliptic, distally regularly serrate, less so proximally, glabrous, to 8.5 × 2.5–3(–3.5) cm, with adaxial surface dark green, shiny, shallowly pitted, lighter green and almost dull below; leaf apex mostly cuspidate, sometimes acute; leaf base obtuse to acute; midrib shallowly sunken adaxially, <1 mm

wide proximally, narrower distally, shortly and finely hairy, red-brown, more so proximally, prominent abaxially, proximally to 2 mm wide, <1 mm wide distally, light green, proximally hairy, with hairs long, orange-red; secondary venation pinnate, not distinct, sometimes so faint on adaxial surfaces as to be invisible, more prominent but still faint abaxially, mostly brochidodromous, sometimes not developed and appearing to be camptodromous, with 4 to 5(6) pairs of veins adaxially, the veins shallowly sunken, abaxially slightly prominent; tertiary venation lacking. Flowers sessile to almost sessile, terminal, solitary, sometimes in pairs, lacking scent; flower buds small, orbicular, densely tomentose, brownish green, but whitish green distally, with developing perules prominent; flowers 2.5–3.5 cm diam. (the relatively small flower size due to folding of mature petals), white, soft, thicker toward center; petals 5, partially twisted along their longitudinal axis, with apices unevenly folded to varying degree, arranged in 2 whorls, glabrous, sometimes frayed distally, not emarginate, overlapping proximally for 0.5–0.8 cm, lacking midrib, with venation absent; petals of outer whorl 2 or 3, (2–)2.5–3.5 × (0.5–)0.75–1.2 cm, slightly concave, sometimes asymmetric, narrowly elliptic to almost oblong, proximally slightly fused to each other, otherwise free; petals of inner whorl 2 or 3, (2–)2.5–3.5 × (0.5–)0.75–1.2 cm, slightly concave, slightly asymmetric, narrowly elliptic to almost oblong, basally attached to stamens for 2–2.5(–3) mm; sepals lacking; perules undifferentiated, often 6 to 10 in 2 uneven whorls, often unevenly triangular, dark brown, finely hairy, 1–3(–4) × 1–3.5(–5) mm, deciduous, not present on mature flowers and fruit; stamens (25 to)35 to 45, glabrous, light yellow, later yellowish brown, in a circular to asymmetrically elliptic formation 1.3–2(–3) cm diam.; filaments white-yellow to yellowish green, (0.8–)1–2 cm × 1–2 mm, glabrous, laterally compressed, straplike, slightly curved, basally fused to each other and to petals of the inner whorl for 2–2.5(–3.5) mm, thus forming a shallow ring; anthers 2-lobed (locules distinct), 1–1.2 × 1 mm or less, light yellow, later brownish yellow, basifixed or nearly so; style single, columnar, sinuous, proximally shortly and densely hairy, less so distally, 2–2.5(–3.2) × 1–1.5 mm proximally; stigma light brown to brown, divided into 3 indistinct lobes that are <1 mm diam.; ovary superior, rounded, almost conical, 3(4)-carpellate, finely and densely tomentose, yellowish green, 2.5–3(–4) × 3–3.5(–3.7) mm. Mature fruit unevenly globose elliptical, always longer than wider, mid- to dark brown, densely hairy, with hairs short and whitish, 3-valved, 2–3 × 2–2.5 cm, not always containing 3 seeds; mature seed light brown, not shiny, laterally compressed, unevenly and finely hairy, 1–1.5 cm diam.

Distribution and ecology. *Camellia ligustrina* is known only from the type location in Lam Dong Province in Vietnam. The type specimen was found at 1850 m, near the summit of Mt. Lang Biang, which reaches 2163 m. The area of the type location is covered by dense, ever-wet rainforest, and *C. ligustrina* seems to thrive in poor, wet, but well-drained soils, under low-light conditions.

IUCN Red List category. The AOO for this new species is estimated to be less than 1 km^2. Despite a further search of the area around the type locality, only seven additional mature plants were located, and a smaller number of immature plants were also found. The total known population of the species is fewer than 50, and it would qualify for assessment as Critically Endangered (CR) under criterion D (IUCN, 2011). However, the area is adequately protected by inclusion in the Bidoup-Nui Ba National Park, and this suggests that the IUCN category of Endangered (EN) would be more appropriate (IUCN, 2011).

Phenology. *Camellia ligustrina* was collected in flower in mid-December. The relatively small number of mature flowers and immature flower buds observed for the new species may indicate that October through November is the main flowering period. The presence of a small number of mature fruits was also noted at the mid-December collection.

Etymology. The specific epithet refers to the striking, but superficial, resemblance of the foliage to *Ligustrum lucidum* W. T. Aiton (Oleaceae).

Discussion. The new species *Camellia ligustrina* was found within a geographical area that contains mostly tropical, large-leaved, rainforest *Camellia* species (Sealy, 1958; Gao et al., 2005; Orel, 2006; Orel & Wilson, 2010b, 2012). Thus its distribution may be judged as somewhat atypical since it is morphologically closer to cool temperate or marginally subtropical *Camellia* species. The striking morphology of *C. ligustrina*—that is, the relatively small size of its foliage and the white color and small size of its flowers—may be due to the elevation where the type specimen was found, ca. 1850 m.

Camellia ligustrina possesses narrowly elliptic to elliptic leaves; sessile to almost sessile, perulate flowers; straplike outer stamens that are basally fused for 2–3 mm; a hairy and almost conical ovary with a single, sinuous, and columnar style up to 3 cm long. Moreover, these characters, combined with the

unevenly globose to elliptical, densely hairy, 3-valved fruit and, the light brown, unevenly and finely hairy seeds, are firm indications that *C. ligustrina* is only superficially similar to any of the *Camellia* species described and contained in the 12 published sections recognized by Sealy (1958). Owing to the combination of its unique morphological characteristics, *C. ligustrina* merits placement in its own section, *Camellia* sect. *Pierrea*.

III. Camellia sect. **Dalatia** Orel. TYPE: *Camellia luteocerata* Orel.

Flowers sessile or subsessile, mostly solitary, intensely yellow, waxy, and fragile; perules mostly 6 (3 + 3) only slightly overlapping, persistent; corolla 9- to 13-merous, the proximal segments petaloid, yellow, and obviously verticillate; other petals irregularly spirally arranged; stamens numerous glabrous, the lower third or more connate and fused to the petals; style connate for two thirds or more of its length; stigma 5-lobed, glabrous; ovary superior, 5-carpellate.

KEY COUPLET TO THE SPECIES OF *CAMELLIA* SECT. *DALATIA*

1a. Filaments fused to petals for one third of their length; style glabrous, stigmas on distinct branches ..... *C. luteocerata* Orel
1b. Filaments fused to petals for up to four fifths of their length; style tomentose, stigmas shortly lobed ..... *C. bugiamapensis* Orel, Curry, Luu & Q. D. Nguyen

1. Camellia bugiamapensis Orel, Curry, Luu & Q. D. Nguyen, sp. nov. TYPE: Vietnam. Binh Phuoc: low lying tropical forest ca. 1 km from Cambodian border, within Bu Gia Map Natl. Park, 18 Dec. 2011 (fl.), *Luu Hong Truong, Nguyen Quoc Dat, G. Orel & A. S. Curry 698* (holotype, SGN; isotype, NSW). Figure 3.

Species nova quae a *Camellia luteocerata* Orel, typo *Camelliae* sectionis *Dalatiae* Orel, foliis ellipticis vel late ellipticis, floribus terminalibus, petalis 9 ad 11, filamentis externis per 4/5 longitudinis ad bases petalorum adnatis et stylo tomentoso columnari stigmate disciformi breviter 5-lobo differt.

Perennial, medium to large evergreen shrubs, to 7 m high, with upright habit, sparsely branched, sometimes multi-stemmed; main stem to 20 cm thick at base; secondary branches slender and ascending at ca. 45°, although branch terminals are semi-pendulous; mature bark smooth, with dull sheen, light brown with gray to whitish blotches, usually with some lichen growth; new shoots thin, initially light green, later gray to brown, glabrous, shiny, turning dull; mature branches concolorous to trunk. Petioles falcate, short and thick, 1–1.5(–2) × 0.3–0.5 cm, distally light green, proximally medium green, on older leaves brown and sometimes corky, with a variably deep longitudinal channel on adaxial side; axillary leaf buds small, rudimentary, laterally compressed, <1 mm diam., initially green, later turning brown to dark brown; terminal leaf buds light to mid-green, glabrous, with scales not prominent; buds slightly falcate, with sharp apex, 0.5–1.2 × 0.3–0.5(–0.7) mm; developing leaves light green with distinct sheen, glabrous, rather thin, elliptic to oval, irregularly serrate, less so proximally, margins proximally slightly undulate, some juvenile leaves with pronounced unevenly serrate leaf margins; mature leaves elliptic, oval to widely elliptic, 18–27.5(–29.5) × 12–14(–15) cm, irregularly serrate, more so distally, with margins slightly undulate proximally, glabrous, rather thin, slightly pitted, adaxial surface mid- to dark green, shiny, lighter green and dull below; leaf apex widely cuspidate to almost acuminate in less developed leaves on lower branches; leaf base obtuse or rounded, some leaves somewhat amplexicaul; midrib narrow, sunken and light green adaxially, prominent and light green to yellowish green abaxially, glabrous, 1.5–3.5 mm wide proximally, <1 mm wide distally, not shiny, rather dull; secondary venation pinnate, distinctly brochidodromous, with (7)8 to 11 pairs of veins, adaxially sunken, abaxially prominent; tertiary venation adaxially indistinct, more prominent and branched abaxially, rather sparse and uneven, but more prominent marginally; areolation well developed, with meshes unevenly tetragonal, oblong to triangular of relatively inconstant size, maximum areole dimensions (0.75–)1.5–2.5 × 1–1.5 cm, decreasing toward leaf margins. Flowers slightly oblong in lateral section, terminal, mostly solitary, but some branches with 3 to 5 flower buds, lacking scent; some mature and all senescing flowers with strongly reflexed, outward curved petals; bracts undifferentiated and distinct; flower buds not numerous, unevenly orbicular, terminal, sessile, dark yellow, with prominent scales; peduncle short and thick, 3–5 × 3–4 mm, dark green, later brown, initially entirely covered by perules, so the flowers appear to be sessile; perules partially deciduous on mature flowers, up to 7, undifferentiated, greenish to yellow brown, concave, lunate, mostly glabrous, sometimes marginally frayed, striations lacking, 0.9–2.5 × 1–2(–2.5) cm; transitional petaloids 4, distinct, yellowish to green, slightly rigid, with faintly visible venation, concave, variable in shape and size, 2–3 × 2–3 cm, basally overlapping, finely hairy, the margins frayed, finely

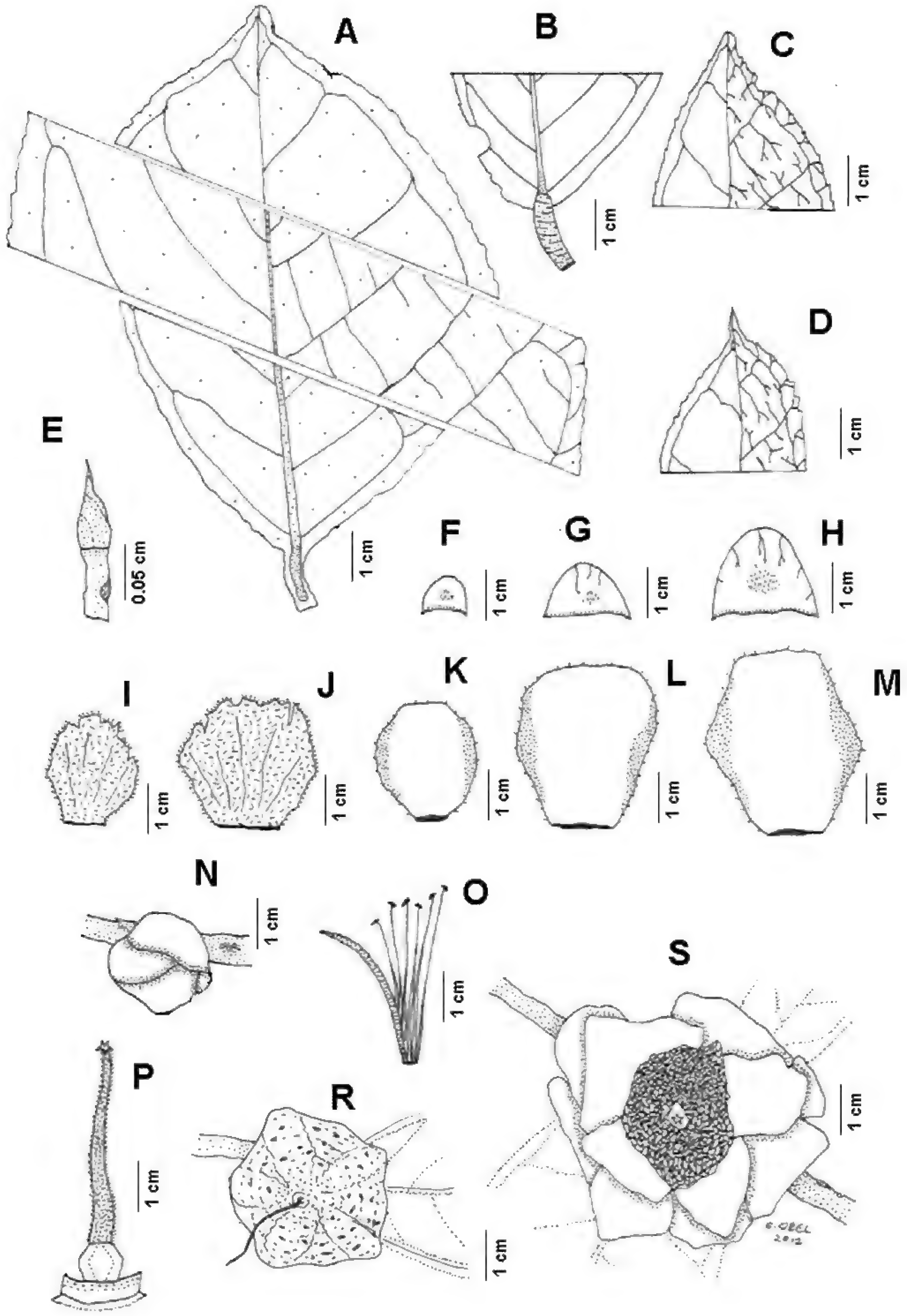


Figure 3. *Camellia bugiamapensis* Orel, Curry, Luu & Q. D. Nguyen. —A. Adult leaf, primary, secondary, and tertiary venation, adaxial view. —B. Adult leaf, leaf base and petiole with primary and secondary venation, abaxial view. —C, D. Adult leaf, leaf apex variation with primary, secondary, and tertiary venation, abaxial view. —E. Terminal leaf bud. —F–H. Undifferentiated perules. —I, J. Transitional petaloids. —K–M. Petals. —N. Developing flower bud. —O. Stamens with adjoining petal. —P. Adult gynoecium, schematic view. —R. Adult fruit capsule. —S. Adult branch with flowers and leaves. Drawn from the holotype *Luu Hong Truong, Nguyen Quoc Dat, G. Orel & A. S. Curry 698* (SGN, NSW).

ciliate; basally overlapping to form a wide and shallow cup; flowers 5–6(–6.5) cm diam., ca. 3 cm thick, bright yellow, later darker; senescing flowers dark yellow, shiny, waxy, with partially translucent, lighter yellow petal margins, hard and rigid, easily damaged; mature flowers with reflexed, outward curved petals; petals 9 to 11, arranged in a random, uneven spiral, unevenly ellipsoid to almost oblong, waxy, brittle, thick, thinner on the margins where they are almost translucent, strongly concave, striations absent, glabrous, with margins sparsely ciliate, without emargination, to 4 × 2.5–3.5 cm, the inner petals proximally attached to stamens for 2–2.5 cm, forming a yellow cupule; stamens ca. 50 to 100, bright yellow, in tight circular formation 2.5–3 cm diam.; filaments bright yellow, thin, glabrous, (2–) 2.5–3.5(–4) cm; outer filaments attached to the inner petals for 2–2.5 cm, some outer filaments arise proximally from inner petals; anthers small but distinct, <1 mm, bright yellow, later light brown, glabrous, basifixed; style single, columnar, slightly sinuous, 13–18 × 2–2.5 mm proximally, light yellow, distally green, finely tomentose, with white hairs; stigma 5-lobed, consisting of 5 small, flat, unevenly circular discs, yellow to brownish; ovary superior, 2.5–3 × 3–4 mm, resting on a 1–2 mm thick base, yellow, glabrous, shiny, with 5 to 6 lobes, each locule containing 2 ovules. Mature fruit unevenly globose, with prominent, brown stylar remnant, with ridging between individual valves also prominent, yellowish brown, with unevenly concentric, dark brown–pigmented markings, glabrous, 6-valved, 2–2.5 × 2.5–3(–4) cm.

Distribution and ecology. *Camellia bugiamapensis* is known only from the type location, which is situated about 1 km from the Cambodian border in the Bu Gia Map National Park, Binh Phuoc Province, Vietnam. The new species was discovered in disturbed lowland tropical forest on elevated ground adjacent to a watercourse.

IUCN Red List category. The known AOO for this new species is estimated to be less than 1 km^2. Despite a further search of the area around the type locality, only a few mature plants were located. We estimate that the total population of the species is fewer than 50 individuals and that it would qualify for assessment as Critically Endangered (CR) under criterion D (IUCN, 2011). However, the area is adequately protected by inclusion in the Bu Gia Map National Park, and this suggests that the IUCN category of Endangered (EN) would be more appropriate (IUCN, 2011).

Phenology. *Camellia bugiamapensis* was collected in flower in December. The first author has photographs of mature fruit taken three months later.

Etymology. The specific epithet of the new species refers to the location of discovery, namely to the Bu Gia Map National Park in Vietnam.

Discussion. The geographic areas delineated for the yellow-flowering species of *Camellia*, most of which were placed in *Camellia* sect. *Archecamellia* Sealy (sensu Sealy, 1958; Ming & Bartholomew, 2007), *Camellia* sect. *Chrysanthae* Hung T. Chang (sensu Chang & Bartholomew, 1984), and *Camellia* sect. *Luteoflorae* Hung T. Chang (sensu Chang & Bartholomew, 1984), comprise the southern provinces of China and the northern provinces of Vietnam (Sealy, 1958; Chang & Bartholomew, 1984; Gao et al., 2005; Ming & Bartholomew, 2007). The newly proposed species, *C. bugiamapensis*, brings the total of yellow-flowering *Camellia* species indigenous to southern Vietnam to between six and eight (two early records are unconfirmed). Recent collections made on Da Lat Plateau are also likely to include further yellow-flowered species. This local concentration of yellow-flowered species in southern Vietnam is significant, as it designates this phytogeographic area as a major repository of indigenous *Camellia* species. It also raises a number of questions regarding the evolution and origins of the genus *Camellia* and Theaceae in general.

IV. Camellia L. sect. **Capitatae** Orel, sect. nov. TYPE: *Camellia capitata* Orel, Curry & Luu.

Inter sectiones alias floribus sessilibus, bracteis 8 ad 10 haud distinctis, sepalis 2, petalis biseriatis, filamentis externis ad bases petalorum affixis, antheris parvis basifixis, stylo unico columnari glabro et ovario 3-carpellato subtriangulari distinguitur.

Leaves elliptic to oval, or almost oblong to obovate; flowers sessile, with 8 to 10 undifferentiated bracts; sepals 2; petals 6, in 2 whorls; stamens numerous, outer stamens attached to inner petals, basally fused; anthers small, distinct, basifixed; style glabrous, single, stout, and columnar, apically shortly 3-fid; ovary 3-carpellate, roughly triangular, glabrous; style single, stout, and columnar, glabrous, with a shortly 3-lobed stigma.

Discussion. *Camellia* sect. *Capitatae* is characterized by having distinct clusters of sessile flowers with undifferentiated bracts.

1. Camellia capitata Orel, Curry & Luu, sp. nov. TYPE: Vietnam. Lam Dong: Cat Tien Natl.

Park, Plot 511, ca. 4 km N of Phuoc Son Forest Station, ca. 200 m, 11 Nov. 2010 (fl.), *Pham Hong Thai & Nguyen Danh Hiep CT5* (holotype, SGN; isotype, NSW). Figure 4.

Species nova quae a *Camellia chrysantha* (Hu) Tuyama, typo *Camelliae* sectionis *Chrysantharum* Hung T. Chang, foliis ellipticis suboblongis vel obovatis, inflorescentia terminali alabastris in fasciculo umbelliformi, petalis 6, stylo columnari et stigmate disciformi breviter 3-lobo differt.

Perennial, medium to large evergreen shrubs to 5 m high, with upright habit, sparsely branched, sometimes multi-stemmed; stems thin; secondary branches light and ascending at ca. 45° angle; mature bark generally smooth, with areas of shallow striations, without sheen, grayish to light brown, with mid- to dark brown, randomly distributed areas of pigmentation, with some lichen growth present; new shoots rather thin, initially light green, later gray to brown, glabrous, dull; mature branches concolorous to trunk. Petiole falcate, short, and stout, 1–1.5(–1.8) × 0.2–0.4 cm, mid- to dark green, finely hairy, the hairs white, with a variably deep but rather shallow longitudinal channel on its adaxial side; axillary leaf buds few, small, rudimentary, laterally compressed, <1 mm diam., initially green, later dark brown; terminal leaf buds and developing leaves not seen; mature leaves elliptic to oval, sometimes almost oblong to obovate, 24–27(–32.5) × 10–12(–13) cm, irregularly serrate, occasionally serrations more pronounced proximally, less so distally, adaxially glabrous, mid- to dark green and shiny, abaxially finely and sparsely hairy, lighter green, and dull or slightly shiny, thin, slightly coriaceous, slightly pitted, margins slightly undulate on larger leaves; leaf apex cuspidate, slightly variable, acute on smaller leaves; leaf base obtuse, almost cordate, acute in less developed leaves; midrib narrowly sunken and mid- to light green adaxially, prominent and light green to yellowish green abaxially, less so distally, 2–4(–5) mm wide proximally, <1 mm distally, finely tomentose, with white hairs, not shiny and rather dull; secondary venation pinnate, distinctly brochidodromous, with (11 to)14 to 16 pairs of veins, adaxially sunken, indistinct, the abaxial veins more prominent, some veins sparsely tomentose; tertiary venation adaxially rather faint, distinct abaxially; areoles well developed and evenly distributed, with meshes unevenly tetragonal, often oblong, to 0.5–1 × 0.7–1.2 cm, marginally decreasing in size toward leaf margins. Flowers sessile, circular, sometimes unevenly rectangular, terminal, lacking scent; senescing flowers with reflexed, inward curved petals; bracts distinct; flower buds numerous, sessile, in clusters of 9 to 12(to 14), forming a simple umbel-like structure, unevenly orbicular, usually longer than wide; bud scales prominent, terminal, initially dark red with yellow margins, later lighter reddish with areas of yellow pigmentation; bracts prominent, 8 to 10, undifferentiated, persistent on mature flowers, strongly concave, variable in size, 5–13 × 7–15 mm, finely tomentose, finely textured, rigid, and hard, reddish, with margins light yellow, sometimes marginally frayed, striations lacking; sepals 2, distinct, ellipsoid to obovate, 2.5–3 × 1–1.5 cm, persistent, light yellow to green, rigid, finely hairy, also hairy on margins, strongly concave, after anthesis forming a wide and shallow cup; flowers uneven and rectangular, 5–5.5 cm diam., light yellow, rather dull, slightly waxy, hard and rigid; mature flowers with inward folded petal margins; petals 6, arranged in 2 whorls; petals of outer whorl 3, unevenly ellipsoid, obovate, waxy, slightly brittle, thick, slightly thinner on margins, concave, without striations, but internal venation faintly visible on abaxial surfaces, glabrous, without emargination, to 3.5 × 1–2.5 cm, proximally attached to petals of inner whorl for 0.9–1.2 cm; petals of inner whorl 3, unevenly ellipsoid, obovate, waxy, slightly brittle, thick, slightly thinner on margins, concave, without striations, but internal venation faintly visible on abaxial surfaces, glabrous, without emargination, to 3.3 × 0.9–2.5 cm, proximally attached to filaments for ca. 1 cm; stamens, ca. 100 or more, light yellow, later light brown, in a loose circular formation 2.5–3 cm diam.; filaments light yellow to cream, glabrous, 2–2.5 cm, outer filaments basally attached to inner petals and to each other for ca. 1 cm; anthers 2 × ca. 1 mm, basifixed, longitudinally striate; style single, stout, columnar, proximally wider than distally, apically trifid for 1–2 mm, 2–2.6 cm, light yellow, glabrous; stigma well defined and prominent, 3-lobed, initially yellow, later brown; ovary superior, 5–7 × to 8 mm, 3-carpellate, roughly triangular, ridging present, from a 1.5–2.5 mm thick base, yellow, glabrous. Capsules not seen.

Distribution and ecology. *Camellia capitata* is known from its type location only, which is situated within the confines of the northern part of the Cat Tien National Park (Cat Loc Sector) in Lam Dong Province, Vietnam. The new species was found in the vicinity of Hamlet 4, Phuoc Cat Commune. *Camellia capitata* occurs sporadically in small groups of mature plants or as solitary specimens throughout the understory of the evergreen, mixed (broadleaf and bamboo), tropical forest. *Camellia capitata* thrives in

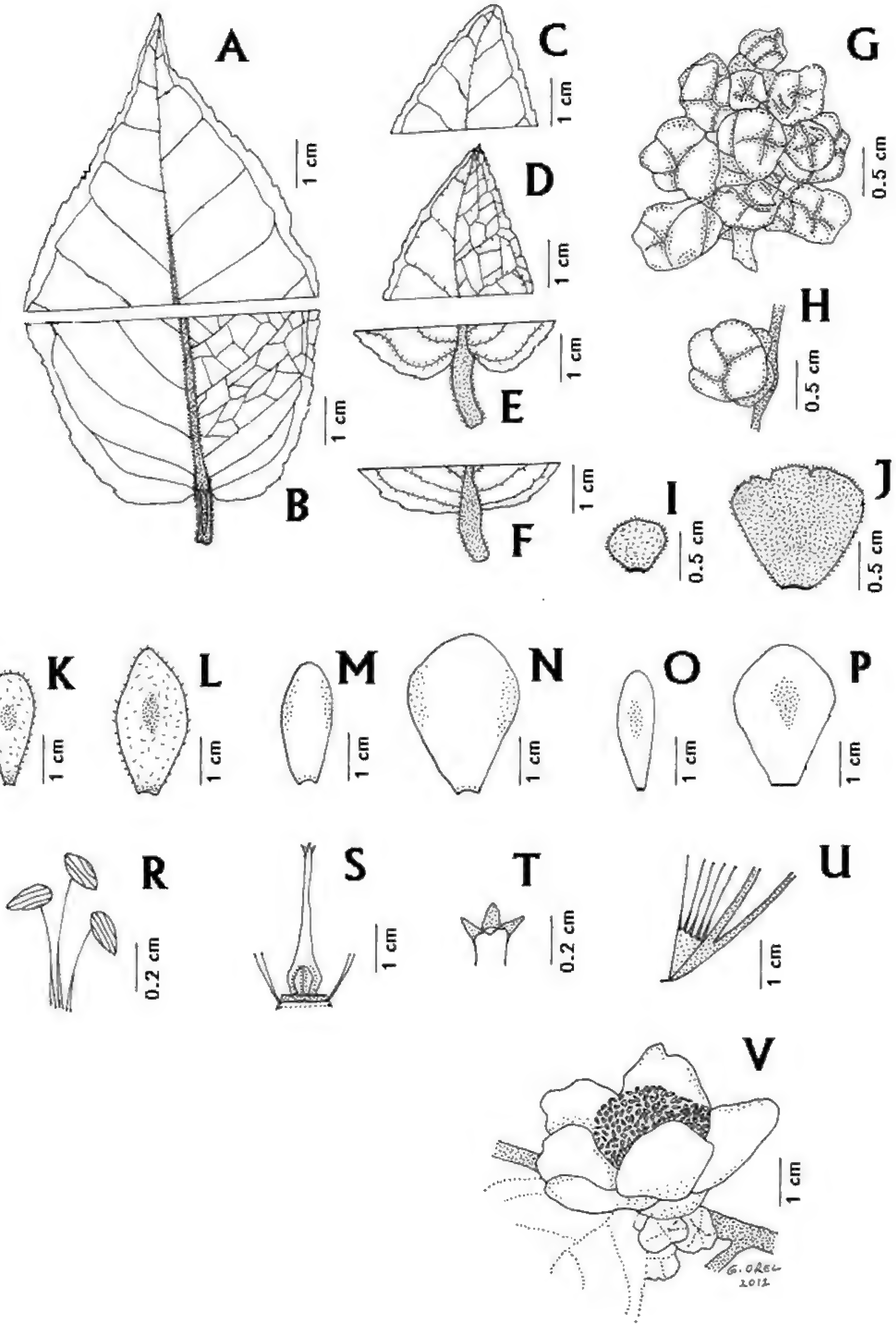


Figure 4. *Camellia capitata* Orel, Curry & Luu. —A. Adult leaf, primary and secondary venation, adaxial view. —B. Adult leaf, primary, secondary, and tertiary venation, adaxial view. —C. Adult leaf, leaf apex variation with primary and secondary venation, adaxial view. —D. Adult leaf, leaf apex variation with primary, secondary, and tertiary venation, abaxial view. —E, F. Adult leaf, leaf base variation with primary and secondary venation, abaxial view. —G. Flower buds. —H. A single flower bud. —I, J. Bracts. —K, L. Sepals. —M, N. Petals, outer whorl. —O, P. Petals, inner whorl. —R. Stamens. —S. Adult gynoecium. —T. Stigma. —U. Lateral view of petal and stamen attachment, schematic diagram. —V. Branch with flowers and leaves. Drawn from the isotype *Pham Hong Thai & Nguyen Danh Hiep CT5* (SGN, NSW).

relatively rich, wet, but well-drained soils and in low-light conditions.

IUCN Red List category. The AOO of this new species is estimated to be less than 1 km^2. Despite a further search of the area around the type locality, only three to five scattered mature plants were located. Given this situation, we consider the IUCN category of Critically Endangered (CR) to be appropriate (IUCN, 2011).

Phenology. *Camellia capitata* was collected in flower in November. No mature fruit capsules or seeds were evident.

Etymology. The epithet of the new section and species refers to the predominant morphological character, namely the flowers borne in a terminal, headlike structure that may be composed of up to 14 flower buds.

Discussion. *Camellia capitata* is distinguished from other *Camellia* species in southern Vietnam by possessing elliptic to oval, or almost oblong to obovate leaves; sessile flowers, with eight to 10 undifferentiated bracts; two sepals; six petals in two whorls; numerous stamens with outer stamens attached to inner petals; basally fused petals; small, distinct and basifixed anthers; 3-carpellate, roughly triangular, and glabrous ovary and a single, stout, columnar, and glabrous style with a shortly trilobed stigma. *Camellia capitata* exhibits a number of unique morphological characters that are not found in the currently known, yellow-flowering *Camellia* species of Vietnam and China.

Acknowledgments. We are grateful to the managers and staff of Lam Dong Province and Bu Gia Map, Cat Tien, and Bidoup-Nui Ba national parks for permits and their kind support and cooperation throughout the field trips. We appreciate the generous and wide-ranging assistance provided by our colleagues and the Southern Institute of Ecology.

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Rediscovery of the Types of *Euphorbia sparsiflora* (Euphorbiaceae) and *Gutierrezia ionensis* (Asteraceae) at MIN

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Abstract. Type specimens of two names (*Euphorbia sparsiflora* A. Heller, Euphorbiaceae, *Gutierrezia ionensis* Lunell, Asteraceae) have been discovered, superseding recent lecto- and neotypifications.

Key words: *Euphorbia*, *Gutierrezia*.

As part of the project to scan the type specimens at the University of Michigan Herbarium (MICH) for the Global Plants Initiative, vascular plant type specimens from several herbaria in the Great Lakes region were also scanned. One of those institutions was the University of Minnesota Herbarium, J. F. Bell Museum of Natural History (MIN).

Before scanning, Rabeler checked each specimen against the types spreadsheet that Cholewa supplied, both to verify the specimen had been sent to MICH and to locate specimens with an unclear type status. In doing so, two significant specimens previously thought by others to be missing were located. In one case, a second lectotype had been designated, and in the other, a neotype. These designations are now unnecessary according to Article 9.19 of the International Code of Nomenclature for algae, fungi, and plants, which states: "9.19 The author who first designates (Art. 7.9 and 7.10) a lectotype or a neotype in conformity with Art. 9.11–13 must be followed, but that choice is superseded if *(a)* the holotype or, in the case of a neotype, any of the original material is rediscovered" (McNeill et al., 2012). We present the typifications here.

Euphorbia sparsiflora A. Heller, Minnesota Bot. Stud. 1: 846. 1897. [= *Chamaesyce sparsiflora* (A. Heller) Koutnik]. Lectotype: Hawaii, Island of Kauai, in and near a bog at the head of the Wahiawa River, 12 Aug. 1895, *A. A. Heller 2699* (MIN), <http://plants.jstor.org/specimen/min1002493>.

Koutnik (1985: 399, 1987: 371) originally listed the MIN specimen as "holotype" in both a paper on new combinations and his revisionary study of Hawaiian *Chamaesyce* Gray. Wagner and Shannon (1999) designated a specimen of *Heller 2699* at US (2064353; photo available at <http://collections.nmnh.si.edu/search/botany>) as lectotype, arguing that the specimen Koutnik (1987) listed as the holotype was not at MIN based on staff not being able to locate it (perhaps due to nomenclatural confusion as specimens of this number were distributed with the name *Euphorbia wahiawae* Heller n. sp, a name never published). As Wagner and Shannon noted, Heller did not assign different collection numbers to each unique gathering of the same species. In such cases, Wagner and Shannon considered each of the specimens bearing that number to be syntypes and often selected a lectotype from them. In this case, Heller cited "2699" in the protologue but did not cite a date. Wagner and Shannon (1999: 431) listed specimens of *2699* collected from the same site on 12 August, 21 August, and 19 October; a collection dated 8 August is at PH (<http://plants.jstor.org/specimen/ph00013711>).

According to MacMillan, via a footnote in Heller (1897, p. 760), "A complete series of this [Heller's Hawaiian] collection . . . including some sixty type specimens" was presented to the "herbarium of the Geological and Natural History Survey" (now MIN), but only one specimen of *Heller 2699* has been found at MIN. As Heller was a faculty member of the University from 1895 to 1900, this set at MIN is considered his primary collection, especially for his types (see discussion in Wagner & Shannon, 1999).

Given the existence of collections of *Heller 2699* made on different dates and the fact that Heller (1897) did not cite a date in the protologue, Koutnik's citation (1985, p. 399) and annotation of the MIN specimen as the holotype should really be considered a lectotypification under Article 9.9 (McNeill et al., 2012). This is consistent with Wagner and Shannon's (1999) treatment of Koutnik's

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typification of the MIN specimen (also as a holotype) of *Euphorbia rivularis*, another example where Heller did not cite a date in the protologue and where plants from several dates were gathered and distributed under a single number. Article 9.19 proscribes that Koutnik's choice is to be followed now that the specimen has been found. The US specimen of the 12 August collection that was designated as lectotype now becomes an isolectotype. Wagner and Shannon (1999) cited additional isolectotypes at BISH, F, GH, MO, and NY; isolectotypes may also be located at A, AC, BM, JE, and MSC (see <http://plants.jstor.org/search?genus=Euphorbia&species=sparsiflora>).

Gutierrezia ionensis Lunell, Amer. Midl. Naturalist 2: 194. 1912. [= *Gutierrezia sarothrae* (Pursh) Britton & Rusby]. Holotype: Oregon, Morrow Co., Ione, 16 July 1903, *J. Lunell s.n.* (MIN), <http://plants.jstor.org/specimen/min1000626>.

Lane (1985), in revising *Gutierrezia* Lag., designated *Lane 3054* as the neotype of *G. ionensis* because, as she noted, "the original material apparently has been lost (G. Ownbey, pers. comm.)." However, this Lunell specimen, complete with the notation as "Type" and the citation for publication on the label in Lunell's hand, is clearly the specimen that Lunell intended as the holotype; therefore, Lane's neotypification must be superseded, and *Lane 3054* has no nomenclatural standing.

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Taxonomic Notes and Two New Species in *Centaurea* sect. *Cynaroides* (Compositae, Cardueae) from Iran

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ABSTRACT. Two new species, *Centaurea kamyaranensis* Ranjbar & Negaresh and *C. bavegehensis* Ranjbar & Negaresh, collected from Kermanshah Province in western Iran are described and illustrated. Both are assigned to *Centaurea* L. sect. *Cynaroides* Boiss. ex Walp. (Asteraceae, Cardueae) on the basis of the racemose synflorescences, the adaxial stem leaves decurrent, the subglobose to ovoid involucres, and the phyllary appendages triangular to ovate or orbicular, not decurrent, usually ciliate and ending in a firm spine or spinule. The new species are closely related to *C. regia* Boiss. subsp. *regia*, but *C. kamyaranensis* differs by its median appendages being narrowly triangular and 17–21 × 10–11 mm, with fewer cilia on each side, subreflexed, and white flowers. *Centaurea bavegehensis* is distinguished by its phyllaries being densely lanate and tomentose, with the appendages concealing a minor part of the phyllaries, the median appendages triangular, 14–16 × 5–6 mm, with two to four cilia on each side, and the cilia 0.8–3 mm. A description of *Centaurea* sect. *Cynaroides* and a key to all the species of the section in Iran are presented here. Both subspecies for *C. regia* in Iran are discussed.

Key words: Asteraceae, *Centaurea*, Iran, IUCN Red List, Kamyaran, Kermanshah, section *Cynaroides*.

Centaurea L. s.l. is one of the largest genera within the Asteraceae in Iran. Recent treatments of *Centaurea* (Wagenitz & Hellwig, 2000; Greuter, 2003a, 2003b; Hellwig, 2004), based on nuclear DNA and morphological evidence (Wagenitz et al., 2006), excluded *Rhaponticoides* Vaill., *Psephellus* Cass., and *Cyanus* Mill. as segregate genera. It has been reported that *Centaurea* s. str. comprises nearly 200 to 250 species (Bremer, 1994; Wagenitz & Hellwig, 1996; Hellwig, 2004; Garcia-Jacas et al., 2006; Susanna & Garcia-Jacas, 2007; López et al., 2011). According to Wagenitz (1955), the *Jacea* Mill. group denotes those taxa with the *Jacea* pollen type. Within this group there are several sections with diversity in habit and in the morphology of appendages of the phyllaries and achenes (Garcia-Jacas et al., 2006). Common characters of the species of this group include: (1) the *Jacea* pollen type, (2) a lateral hilum (used by Dittrich [1968] as a diagnostic character), and (3) sterile peripheral florets without staminodes (Wagenitz & Hellwig, 1996, 2000). The *Jacea* group includes 18 sections of *Centaurea*: section *Jacea* (Mill.) DC., section *Cheirolepis* (Boiss.) O. Hoffm., section *Rhizocalathium* Tzvelev, section *Grossheimia* (Sosn. & Takht.) Dittrich, section *Chartolepis* (Cass.) DC., section *Phaeopappus* (DC.) O. Hoffm., section *Cynaroides* Boiss. ex Walp., section *Paraphysis* (DC.) Wagenitz, section *Microlophus* (Cass.) DC., section *Pseudoseridia* Wagenitz, section *Mesocentron* (Cass.) DC., section *Calcitrapa* DC., section *Tetramorphaea* (DC.) Boiss., section *Pteracantha* Wagenitz, section *Melanoloma* (Cass.) DC., section *Pluraosipappus* (Czerep.) Wagenitz, section *Pseudophaeopappus* Wagenitz, and section *Ptosimopappus* O. Hoffm. (Wagenitz, 1955, 1975, 1980; Wagenitz & Hellwig, 1996, 2000; Garcia-Jacas et al., 2000, 2006; Greuter, 2003a; Ranjbar et al., 2013). Results from molecular studies on the *Jacea* group have presented a clear picture of *Centaurea* sect. *Cynaroides* along with other closely affined sections (Garcia-Jacas et al., 2000, 2006). Then, the informal *Jacea* group is supported as a major clade within the *Centaurea*, and the older name *Centaurea* subg. *Jacea* (Mill.) Hayek should be taxonomically recognized.

In *Flora Iranica* (Wagenitz, 1980), 70 species in 28 sections were accepted for the genus *Centaurea* in the country. Since then, six new taxa, namely *C. iranshahrii* Wagenitz & Esfand., *C. ghahremanii* Wagenitz & Esfand., *C. elymaitica* Mozaff., *C. regia* Boiss. subsp. *javanroudensis* Ranjbar & Negaresh, *C. shahuensis* Ranjbar & Negaresh, and *C. ravansarensis* Ranjbar & Negaresh, have been described from Iran (Wagenitz & Esfandiari, 1983; Mozaffarian, 2006; Ranjbar et al., 2012, 2013). *Centaurea gigantea* Sch. Bip. ex Boiss. was also added as a new record for Iran by Ghahreman and Attar (2000). *Centaurea* sect. *Cynaroides* is significantly represented in Iran,

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comprising seven species, two of which, namely *C. phlomoides* Boiss. & Hausskn. ex Boiss., and *C. geluensis* Boiss. & Hausskn. ex Boiss., are endemic (Wagenitz, 1980). In Iran, species from *Centaurea* sect. *Cynaroides* occur on clay, stony substrates as well as roadsides, shrublands, steppes, fallow fields, limestone cliffs, dry hills, and rocky slopes, and range between 800 and 2700 m in altitude (Ranjbar et al., 2013).

During field excursions in Iran, we collected several specimens generally identifiable as *Centaurea* sect. *Cynaroides*. Upon further investigation, the morphological differences among these populations initially recognized as *C. regia* subsp. *regia* are sufficiently consistent to distinguish the two new species described herein.

KEY TO *CENTAUREA* SECT. *CYNAROIDES* SPECIES IN IRAN

1a. Appendages totally concealing the phyllaries 2
1b. Appendages not concealing the phyllaries 4
2a. Capitula 5 to 15, in racemes or spikes; appendages rounded or broadly ovate; flowers pale rose to rose or purple 3
2b. Capitula 1 to 4, in loose corymbs; appendages oblong or lanceolate; flowers yellow ..... *C. geluensis*
3a. Involucres 30–40 mm wide; spine 1–3(–4) mm; cilia 1–4 mm; pappus 5–9 mm ..... *C. imperialis* Hausskn. ex Bornm.
3b. Involucres 40–50 mm wide; spine (8–)9–14 mm; cilia (3–)4–6 mm; pappus 10–13 mm ..... *C. regia*
4a. Capitula arranged in racemes or solitary; appendages of phyllaries not reflexed 5
4b. Capitula arranged in densely congested corymbs; appendages of phyllaries reflexed ..... *C. phlomoides*
5a. Plants with a tapering taproot; involucres (35–)40–50 × (35–)40–50 mm; pappus 12–13(–14) mm 6
5b. Plants with the root napiform and fusiform; involucres 30–35 × (20–)25–30 mm; pappus 8–10 mm ..... *C. gigantea*
6a. Capitula 4 or 5; involucres ovate-cupuliform or ovate; median and inner appendages straw-colored, the median ones 14–16 × 5–6 mm; cilia 2 to 4 on each side, 0.8–3 mm; flowers pale rose, 50–55 mm ..... *C. bavegehensis* Ranjbar & Negaresh
6b. Capitula 14 to 16; involucres globose or globose to conical; median and inner appendages purple to deep purple, the median ones 17–21 × 10–11 mm; cilia 2 to 7(to 9) on each side, 2–5(–6) mm; flowers white, yellow when dry, 37–42 mm ..... *C. kamyaranensis* Ranjbar & Negaresh

Centaurea sect. **Cynaroides** Boiss. ex Walp., Repert. Bot. Syst. 6: 300. 1846. TYPE: *Centaurea regia* Boiss.

Biennials with a thickened taproot or perennials, sometimes with the radix napiform; stems stout, erect, branched above, sometimes suffrutescent. Basal leaves mostly larger than above ground, broadly lanceolate to cordate or lyrate; median and adaxial cauline leaves often decurrent. Capitula numerous, large to very large, often arranged in a raceme or spike; involucres usually subglobose or ovate or ovate-oblong; apical appendages of phyllaries firm or rigid, triangular to ovoid or orbicular or oblong, not decurrent, usually ciliate and ending in a firm spine or spinule, more rarely entire and spiny or ciliate without terminal spine; cilia erect, sometimes reflexed. Flowers rose, purple or white (yellow when dry), marginal ones radiant or usually finely dissected. Achenes large, 5 mm or longer; pappus longer than achenes in most species, scabrous, inner row short.

1. Centaurea kamyaranensis Ranjbar & Negaresh, sp. nov. TYPE: Iran. Kermanshah: Kamyaran, 5 km to Ravansar, Bave Geh village, 1418 m, 31 June 2012 (fl.), *M. Ranjbar & K. Negaresh 28802* (holotype, BASU, photo at MO). Figure 1.

Haec species *Centaureae regiae* Boiss. subsp. *regiae* affinis, sed ab ea foliis caulinis inferioribus late ovatis vel ovato-lanceolatis vel subcordato integris vel rare denticulatis 25–32 × 12–14 cm (nec late lanceolatis integris vel in parte inferiore pinnatilobis ca. 20 × 10 cm), medianis panduratis vel late oblanceolatis vel oblongis (nec lanceolatis vel oblongis), superioribus ± dense arachnoideis (nec laxe articulato-hirsutis), phyllariis dense floccoso-tomentosis (nec glabrescentibus), appendicibus purpureis vel atropurpureis (nec albidis) phyllaria non omnino occultantibus, exterioribus longe triangularibus (nec ovatis), medianis anguste triangularibus 17–21 × 10–11 mm (nec late ovatis 20–25 × 20–25 mm), ciliis lateralibus subreflexis utrinque 2 ad 7(ad 9) et 2–5(–6) mm longis (nec erectis 10–17 et [3–]4–6 mm longis), spina terminali appendicum medianarum 7–10 mm (nec [8–]9–14 mm) longa atque flosculis in vivo albidis in sicco flavis 37–42 mm longis (nec in vivo roseis, in sicco purpureis ca. 45 mm longis) differt.

Biennial herbs, 130–140 cm tall; stems stout, erect, usually simple, greenish, ca. 17 mm basal diam., cylindrical, finely white-striate, densely leafy at median part, abaxial portion reddish and glabrous, sometimes sparsely covered with arachnoid trichomes, median part ± densely hirsute with articulate trichomes, mixed with arachnoid and sessile glandular trichomes, adaxial stem portion ± sparsely covered with arachnoid and sessile glandular trichomes. Leaves rigid, papyraceous (when dry), with hirsute indument of articulate trichomes, densely so on midrib and veins, the trichomes to 1.5 mm, and with sessile minutely glandular trichomes, blade margins subscabrous, veins prominent on both sides; basal leaves not known; abaxial cauline leaves simple, 25–32 × 12–14 cm, broadly ovate or ovate-lanceolate or subcordate, with petiole 7.5–9.5 cm, with basal auricles, acute at apex, entire, rarely denticulate; median cauline leaves sessile, narrowly decurrent to 2.3 cm, pandurate or

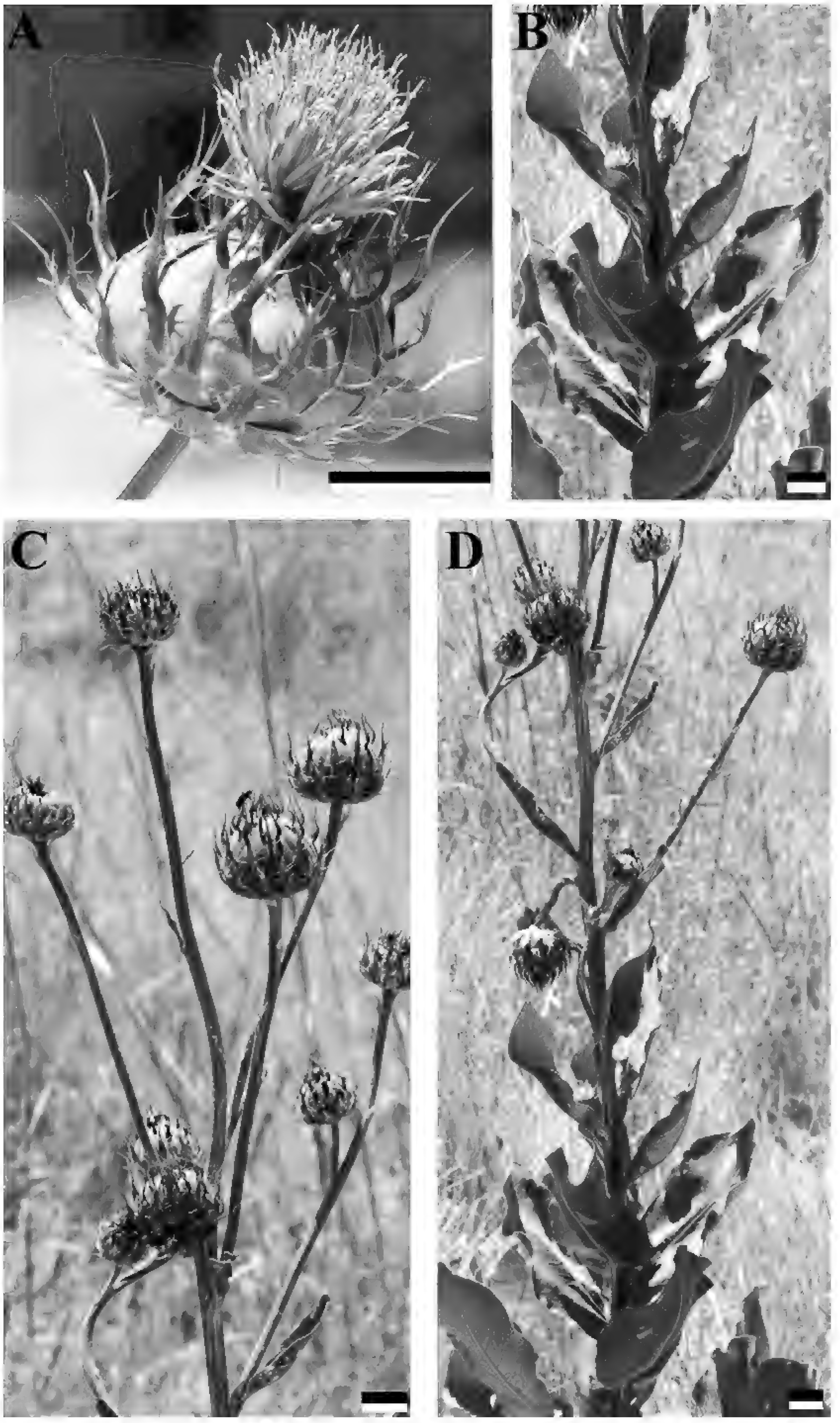


Figure 1. *Centaurea kamyaranensis* Ranjbar & Negaresh. —A. Capitulum. —B. Median cauline leaves. —C. Raceme of capitula. —D. Habit. Scale bars: A, C, D = 2 cm; B = 3 cm. Photos taken from the type locality for the holotype, *Ranjbar & Negaresh 28802* (BASU).

broadly oblanceolate or oblong, 13–24.5 × 5–13 cm, ± densely covered with hirsute indument of articulate trichomes sometimes mixed with arachnoid trichomes, acute at apex, entire; adaxial cauline leaves increasingly smaller, sessile, 4.5–12.5 × 0.6–3 cm, lanceolate, sometimes bractlike, ± densely arachnoid pubescent, the trichomes to 6 mm, the blades elongated acuminate at apex, narrowly decurrent at

base for up to 2.5 cm. Capitula numerous, 14 to 16, arranged in racemes, the adaxial capitula on peduncles ca. 23 cm long, sometimes with bracts similar to phyllaries with small stramineous or chaffy appendages; involucres globose or globose to conical, 40–50 × 40–50 mm; phyllaries multiseriate, green, but reddish above, imbricate, coriaceous to scarious, densely floccose-tomentose; outer phyllaries ovate to oblong, 4–8.5 × 6–7 mm, the appendages elongate triangular, 12–16 × 8–10 mm (including cilia and spine), stramineous to pale purple; median phyllaries broadly lanceolate, 11–14 × 9–11 mm, the appendages narrowly triangular, 17–21 × 10–11 mm (including cilia and spine), gradually narrowing into a spine 7–10 mm long, purple; inner phyllaries lanceolate or linear, 18.5–26 × 9.5–10.5 mm, the appendages narrowly oblong, 16–20 × 4–10 mm (including cilia and spine), gradually narrowing into a 8–12 mm spine, deep purple; appendages partially concealing phyllaries, rigid or chartaceous, not decurrent, ± patent; cilia narrowly triangular, subreflexed, 2 to 7(to 9) on each side, 2–5(–6) mm; spines narrowly triangular, much longer than adjacent cilia. Flowers white in vivo, yellow in sicco; central florets hermaphroditic, 37–42 mm; corolla ± 18 mm, 5-lobed, the lobes 7–9 mm, with yellowish nerves; anthers pink, short or equal to the corolla, with apical appendages acute; stigma exserted from corolla to 4 mm; peripheral florets finely dissected, not radiate, 4-lobed, the limb lobe linear, the lobes 6.5–7 mm. Achenes immature; pappus persistent, multiseriate, scabrous, white, ca. 13–13.5 mm.

Distribution and ecology. *Centaurea kamyaranensis* is a rare endemic in western Iran, found only along roadsides and in fallow fields around Bave Geh village between Kamyaran and Ravansar in Kermanshah Province. The new species was observed on rocky slopes.

IUCN Red List category. *Centaurea kamyaranensis* is known only from the one population in the type locality occupying an area of 2 km^2. The population was not in good condition at the time of our fieldwork, and numbered approximately 50 to 100 plants. According to IUCN Red List criteria (IUCN, 2001), *C. bavegehensis* should be considered Critically Endangered (CR), based on its local distribution and small population size.

Etymology. The specific epithet refers to the city of Kamyaran, which is near the type locality of the new species.

Discussion. *Centaurea kamyaranensis* is similar to *C. regia* subsp. *regia* in the papyraceous texture of leaves and by the adaxial cauline leaves being lanceolate and narrowly decurrent. However, the new species differs significantly, with the indument of the stem varying from glabrous or sparsely arachnoid below, to medially more or less densely hirsute, with arachnoid and sessile glandular trichomes intermixed in indument, with less indument apically (vs. arachnoid and tomentose to glabrescent stems in *C. regia* subsp. *regia*). The abaxial cauline leaves in *C. kamyaranensis* are broadly ovate to broadly lanceolate or subcordate, entire or rarely denticulate, 25–32 × 12–14 cm (vs. broadly lanceolate, entire or in pinnatilobed in the abaxial part, and ca. 20 × 10 cm in *C. regia* subsp. *regia*). The median cauline leaves in *C. kamyaranensis* are pandurate or broadly oblanceolate or oblong (vs. lanceolate or oblong), and the adaxial cauline leaves are more or less densely arachnoid pubescent (vs. sparsely hirsute, with articulate trichomes). When comparing floral structures, *C. kamyaranensis* has globose to conical involucres (vs. subglobose in *C. regia* subsp. *regia*), densely floccose-tomentose phyllaries (vs. glabrescent), and medium-sized (concealing only part of the phyllaries) and purple to deep purple appendages (vs. larger, totally concealing the phyllaries, and white). The outer appendages in *C. kamyaranensis* are elongate triangular (vs. ovate); the median appendages are narrowly triangular and 17–21 × 10–11 mm (vs. broadly ovate and 20–25 × 20–25 mm); and the inner appendages are narrowly oblong (vs. ovate), with fewer cilia on each side, 2–5(–6) mm long, and subreflexed (vs. 10 to 17 on each side, [3–]4–6 mm, and erect). The spines of the median appendages in *C. kamyaranensis* are generally shorter (vs. [8–]9–14 mm), and the flowers are smaller, 37–42 mm in central florets, and white in color (vs. rose, ca. 45 mm). Both species have a similar geographical range in western Iran and may be considered sympatric.

2. Centaurea bavegehensis Ranjbar & Negaresh, sp. nov. TYPE: Iran. Kermanshah: Kamyaran, 5 km to Ravansar, Bave Geh village, 1418 m, 31 June 2012 (fl., fr.), *M. Ranjbar & K. Negaresh 28812* (holotype, BASU, photo at MO). Figure 2.

Haec species *Centaureae regiae* Boiss. subsp. *regiae* affinis, sed ab ea foliis caulinis inferioribus denticulatis (nec integris vel in parte inferiore pinnatilobis), medianis oblanceolatis vel oblongis (nec lanceolatis vel oblongis), involucro ovato-cupuliformi vel ovato 35–45 × 35–45(–47) mm (nec subgloboso 40–55 × 40–60 mm), phyllariis dense lanato-tomentosis (nec glabescentibus), appendicibus phyllaria non omnino occultantibus, exterioribus triangularibus (nec ovatis), medianis triangularibus 14–16 × 5–6 mm (nec late ovatis 20–25 × 20–25 mm), ciliis utrinque 2 ad 4, 0.8–3 mm longis (nec 10 ad 17, [3–]4–6 mm longis), spina

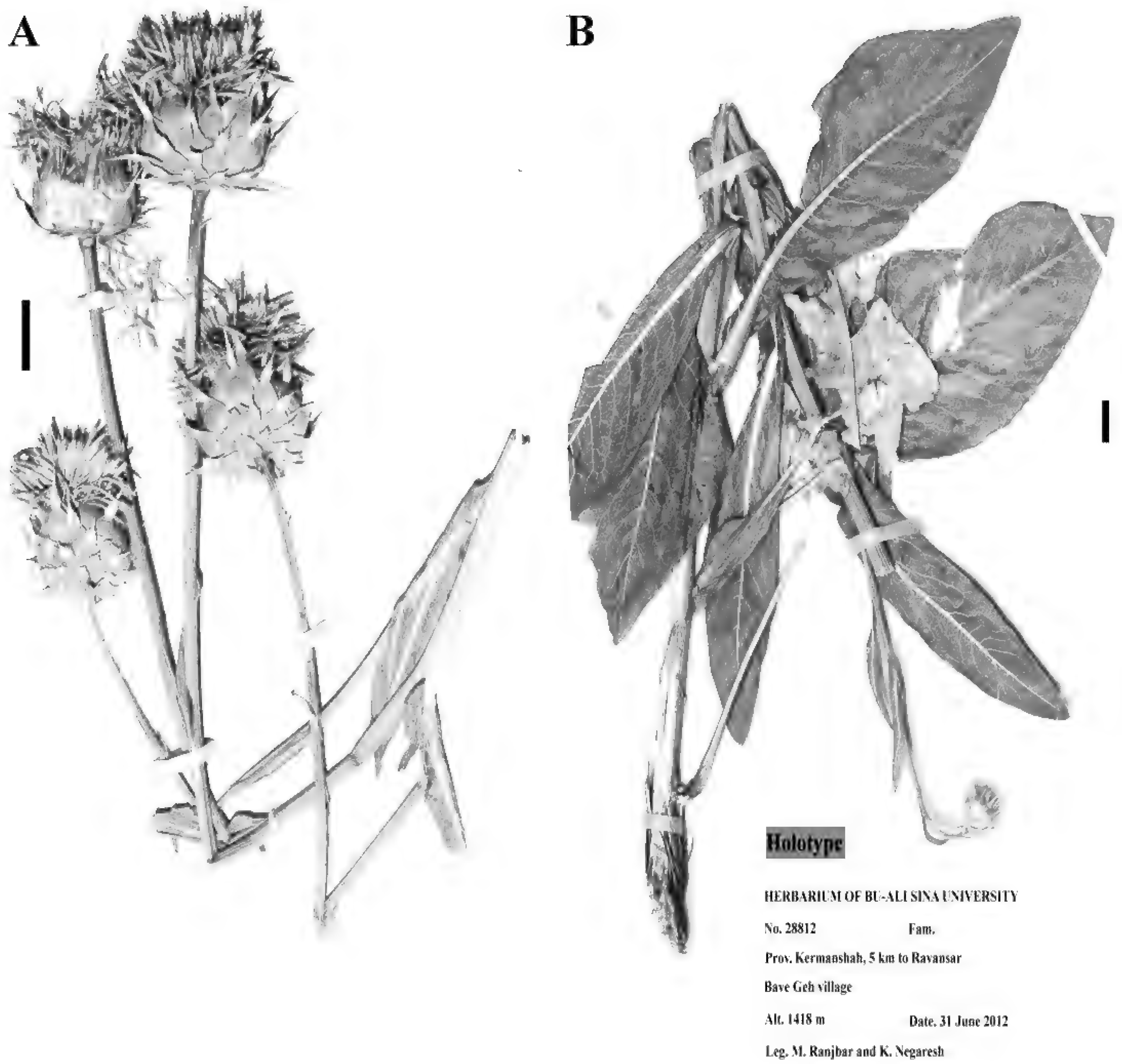


Figure 2. *Centaurea bavegehensis* Ranjbar & Negaresh. —A. Capitula. —B. Habit and median cauline leaves. Scale bars: A, B = 2 cm. Photos from the holotype, *Ranjbar & Negaresh 28812* (BASU).

terminali appendicum medianarum 6–9 mm (nec [8–]9–14 mm) longa, flosculis dilute rosei 50–55 mm longis (nec roseis ca. 45 mm longis) atque hilo piloso (nec glabro) differt.

Biennial with thick fleshy taproot; collum neck with fibrous remnants of petioles from previous year; plants ca. 1 m tall; stem erect, usually simple, yellowish or pale green, ca. 11 mm basal diam., cylindrical, finely white striate, loosely leafy in median part, the abaxial portion sparsely hirsute, with articulate trichomes to 1 mm, the median stem indument mixed with sessile glandular trichomes, the adaxial stem with similar hirsute indument with scattered arachnoid sessile glandular trichomes. Leaves rigid, papyraceous (sicco), sparsely hirsutulous with articulate trichomes, sometimes denser along the midrib, and sessile glandular trichomes; blade margins subscabrous; basal leaves withered at flowering, apparently with a long petiole to 11 cm, reddish; abaxial cauline leaves simple, lanceolate, ca. 25 × 8 cm, subcuneate at the base, with the petiole ca. 9 cm, basally auriculate, acute at apex, denticulate; median cauline leaves sessile, broadly decurrent, to 4.5 cm wide, oblanceolate or oblong, 15.5–20 × 3–8 cm, acute or subacuminate at apex, entire; adaxial cauline leaves acropetally smaller, sessile, lanceolate to narrowly lanceolate or linear, 1.5–12 × 1–3 cm, sometimes bractlike, sparsely hirsutulous with articulate trichomes, mixed with scattered arachnoid trichomes (especially on margins), sometimes with the arachnoid trichomes ± predominant in the indument, acuminate or acute at apex, sometimes narrowly decurrent at base for up to 1.5 cm. Capitula 4 or 5, arranged in racemes, the

adaxial capitula on peduncles ca. 27 cm, sometimes with bracts similar to phyllaries with small stramineous or chaffy appendages; involucres ovate-cupuliform or ovate, the base truncate, 35–45 × 35–45(–47) mm; phyllaries multiseriate, greenish yellow, imbricate, coriaceous to scarious, densely lanate and tomentose; outer phyllaries ovate to oblong, 4.5–9.5 × 5–9.5 mm, with the appendages triangular, 8.5–9 × 6–7 mm (including cilia and spine), gradually narrowing into a 2.8–4.8 mm spine; median phyllaries broadly oblong, sometimes ovate to oblong, 12.5–17 × 10.5–12 mm, with appendages triangular, 14–16 × 5–6 mm (including cilia and spine), gradually narrowed to spine 6–9 mm; inner phyllaries lanceolate or linear, 20–30 × 10–12.5 mm, with appendages narrowly triangular, 13–16.5 × 4–6 mm (including cilia and spine), gradually narrowed to spine 8–10.2 mm; appendages small, concealing a minor part of the phyllaries, rigid and chartaceous, not decurrent, stramineous in color or chaffy in texture; cilia narrowly triangular, erect, few, 2 to 4 on each side, 0.8–3 mm; spines narrowly triangular, much longer than adjacent cilia. Flowers pale rose; central florets hermaphroditic, 50–55 mm when mature; corolla ca. 17 mm, 5-lobed, the lobes 7.2–9 mm, with reddish nerves; anthers ± equal to corolla, with apical appendages acute or obtuse; stigma exserted from corolla to 5 mm; peripheral florets finely dissected, not radiant, 4-lobed, the limb lobe linear, the lobes ± 8 mm. Achenes oblong, 7–7.2 × 3.9–4.1 mm, smooth and shiny, white, rounded at apex, glabrous; hilum lateral, ca. 0.5–0.8 mm, pilose; pappus persistent, multiseriate, scabrous, pale brown, ca. 12 mm.

Distribution and ecology. *Centaurea bavegehensis* is a rare endemic in western Iran and is known only along roadsides and fallow fields around Bave Geh village between Kamyaran and Ravansar in Kermanshah Province. The new species was observed and collected from rocky slopes.

IUCN Red List category. *Centaurea bavegehensis* is known only from one population in the type locality occupying an area of 500 m^2. The population was not in good condition at the time of our fieldwork, and numbered approximately 40 to 80 plants. According to IUCN Red List criteria (IUCN, 2001), the new species should be considered Critically Endangered (CR) based on its local distribution and small population size.

Etymology. The specific epithet refers to the type locality near Bave Geh village in Kermanshah Province, where the new species was collected.

Discussion. *Centaurea bavegehensis* is similar to *C. regia* subsp. *regia* in having the adaxial cauline leaves narrowly decurrent, the leaves papyraceous, and the broad stem diameter to 12 mm. The new species differs significantly in the abaxial part of the stem being sparsely hirsute with articulate trichomes, the median portion similarly so, and the adaxial stems with intermixed arachnoid and hirsutulous indument, sparsely so (vs. arachnoid-tomentose indument, becoming glabrescent in *C. regia* subsp. *regia*). The leaves distinguish both species. In *C. bavegehensis*, the abaxial cauline leaves are lanceolate, denticulate, and ca. 25 × 8 cm (vs. broadly lanceolate, entire or in the abaxial portion pinnatilobed, ca. 20 × 10 cm in *C. regia* subsp. *regia*), and the adaxial cauline leaves have a sparse indument of short hirsute and arachnoid trichomes, especially along margins, with the arachnoid trichomes sometimes more predominant (vs. simply a sparse hirsute indument, with articulate trichomes). When comparing the inflorescences in both species, *C. bavegehensis* has involucres that are ovate-cupuliform or ovate and 35–45 × 35–45(–47) mm (vs. subglobose and 40–55 × 40–60 mm in *C. regia* subsp. *regia*). In the new species, the phyllary indumentum is densely lanate and tomentose (vs. glabrescent), and the appendages are small (concealing only a minor part of the phyllaries) and stramineous in color (vs. larger, totally concealing the phyllaries, and white); the outer appendages are triangular (vs. ovate); and the median appendages are triangular and 14–16 × 5–6 mm (vs. broadly ovate and 20–25 × 20–25 mm). There are two to four cilia on each side of the phyllaries with cilia 0.8–3 mm in *C. bavegehensis* (vs. 10 to 17 and [3–]4–6 mm), and the spine of the median appendages is 6–9 mm (vs. [8–]9–14 mm). In the new species, the flowers are pale rose and 50–55 mm (vs. rose and smaller, ca. 45 mm), and the hilum is pilose (vs. glabrescent). Both species also have a similar geographical range in Iran and are known to be distributed only in the western part of the country.

3. Centaurea regia Boiss., Diagn. Pl. Orient., ser. 1, 6: 135. 1845. TYPE: Assyria. "in deserto ad Tigridem," s.d., *C. G. T. Kotschy 371* (holotype, G; isotypes, BM, K, W).

3a. Centaurea regia subsp. **regia**

Centaurea regia subsp. *regia* is broadly distributed across Syria, Iraq, Turkey, and Iran (Boissier, 1875; Wagenitz, 1975, 1980; Aslan et al., 2011), but in Iran, the autonymic subspecies is very rare, known only from two collections in Kermanshah Province. *Centaurea regia* subsp. *regia* is principally distrib-

uted in fallow fields and along roadsides around the Shahu Mountains. This subspecies is distinguished by the arachnoid-tomentose indument on stems, the outer appendages that are ovate and not decurrent, and the median appendages on the phyllaries that are white.

Selected specimen examined. IRAN. **Kermanshah:** 5 km to Ravansar, Bave Geh village, 1418 m, *M. Ranjbar & K. Negaresh 28807* (BASU).

3b. Centaurea regia subsp. **javanroudensis** Ranjbar & Negaresh, Biol. Diversity Conservation 5(1): 5–10. 2012. TYPE: Iran. Kermanshah: Javanroud to Taze Abad, 1350 m, 7 June 2008, *M. Ranjbar & K. Negaresh 16105* (holotype, BASU).

Centaurea regia subsp. *javanroudensis* is a rare taxon, endemic to Kermanshah Province, Iran, and known only from two localities around Javanroud. This subspecies differs in having the outer phyllary appendages that are broadly cordate and decurrent and median appendages on the phyllaries that are brown-purple.

Selected specimen examined. IRAN. **Kermanshah:** Kermanshah to Javanroud, 25 km to Javanroud, 1450 m, *M. Ranjbar & K. Negaresh 28819* (BASU).

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Opuntia gallegiana, una Nueva Especie Productora de Xoconostle de Zacatecas, México (Cactaceae)

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Resumen. Se describe una nueva especie de *Opuntia* Mill. (Cactaceae), endémica de la región de Sain Alto, Municipio de Sain Alto, estado de Zacatecas, México. Los lugareños la llaman: zarco o xoconostle (en náhuatl, "xoco" = "ácido"; "noxtle" = "tuna"). El nuevo taxón es un árbol, su tronco escamoso, negro, con haces de cerdas blancas, cortas. La primera rama leñosa es paralela al suelo: la epidermis posee cortos tricomas, las aréolas de los cladodios están dispuestas en 16 a 18 series; las espinas son (tres)seis a ocho, emergen de la parte inferior y lateral de todas las aréolas, son aciculares, de 0.6–1.6 cm de largo, reflejas, las laterales horizontales, blancas con la base y el ápice ambarinos. Las flores son de color amarillo pálido a verdosas y el pericarpelo verde pálido, pulverulento; los frutos son de color rosa pálido, paredes exteriores muy delgadas, sin espinas, las paredes interiores gruesas, rosa pálidas, ácidas, no se desprenden del cladodio al madurar; semillas dispuestas en el centro del fruto, con funículos secos, de color rosa. La nueva especie se compara con cuatro especies simpátricas con tricomas en la epidermis, todas productoras de xoconostles: *O. guilanchi* Griffiths, *O. leucotricha* DC., *O. oligacantha* C. F. Först. y *O. spinulifera* Salm-Dyck. Asimismo, se asigna a *Opuntia* serie *Leucotrichae* Britton & Rose que agrupa especies arbóreas, con epidermis pubescente y frutos ácidos.

Abstract. We describe a new species of *Opuntia* Mill. (Cactaceae), endemic to the region of Sain Alto, from the municipio of Sain Alto, Zacatecas, Mexico. The locals call it zarco or xoconostle (in nahuatl, "xoco" = "acid"; "noxtle" = "tuna"). The new taxon is a tree, its trunk scaly, black in color, with tufts of white short bristles. The first woody branch is parallel to the ground: the epidermis has short trichomes, the areoles of the cladodes are arranged in 16 to 18 series, spines are (three)six to eight, emerging from the lower and lateral sides on all areoles, acicular, 0.6–1.6 cm long, reflexed, the lateral ones horizontal, spines are white in color with an amber base and apex. The flowers are pale yellow to greenish and the pericarpel is pale green, powdery; the fruits are pale pink, the exterior walls very thin, spineless, the inner walls thick, pale pink in color, acidic, and persistent on the cladodes when mature; seeds disposed in the center of the fruit, with dry funiculi, rose in color. The new species is compared with four sympatric species with trichomes on the epidermis and all producing xoconostles: *O. guilanchi* Griffiths, *O. leucotricha* DC., *O. oligacantha* C. F. Först., and *O. spinulifera* Salm-Dyck. The new species is assigned to *Opuntia* ser. *Leucotrichae* Britton & Rose, which includes three species with pubescent epidermis and acidic fruits.

Key words: Cactaceae, IUCN Red List, México, *Opuntia* ser. *Leucotrichae*, xoconostle, Zacatecas.

En México se reconocen 90 especies y 23 variedades o subespecies de nopales nativos del género *Opuntia* Mill. (Cactaceae), productoras de tunas, de las cuales unas 18, producen xoconostles (en náhuatl, "xoco" = "ácido"; "noxtle" = "tuna") (Scheinvar et al., 2010). En el estado de Zacatecas, México, que posee gran diversidad de especies de *Opuntia*, se encuentran 43 nopales silvestres, lo que corresponde a 46% del total de 93 especies de nopales silvestres mexicanos. El Municipio de Sain Alto abarca 1446 km² y 1.9% del área total de Zacatecas. Entre las especies de nopales distribuidas en el Municipio de Sain Alto, cuya vegetación es de matorral xerófilo; se encuentran 10 diferentes especies productoras de xoconostles, lo que corresponde al 55.5% del total de las 18 especies conocidas (Apéndice 1) y se ha observado la presencia de algunas especies silvestres aún no descritas. Las nopaleras en esta área son relictos de lo que fue el Gran Tunal, actualmente muy fragmentado y en proceso de destrucción por actividades agrícolas y ganaderas, utilizado principalmente como potreros, donde el ganado bovino y los toros bravos se alimentan de los frutos de los xoconostles que se encuentran sobre los cladodios de las plantas vivas y en sus migraciones diseminan sus semillas fértiles en sus excrementos (Scheinvar et al., 2009). Los campesinos de la región no comercializan ni

Cuadro 1. Características de las especies productoras de xoconostles con tricomas en la epidermis, Municipio de Sain Alto, Zacatecas.

	Opuntia gallegiana Scheinvar & Olalde	*O. guilianchi* Griffiths	*O. leucotricha* DC.	*O. oligacantha* C. F. Först.*	*O. spinulifera* Salm-Dyck
Hábito	arbóreo, copa amplia tupida	arbóreo, copa abierta	arbustivo, copa abierta, poco extendida	arbustivo, copa abierta extendida	arbóreo, copa amplia
Tronco	escamoso, negro, pocos mechones con tufos de cerdas cortas y rectas	escamoso, marrón claro, formando cordones paralelos entre sí, sin espinas	escamoso, marrón grisáceo, con espinas cortas	escamoso, grisáceo, sin espinas	escamoso, grisáceo negruzco, recubierto de mechones aislados con numerosos pelos largos y crespos
Cladodios	subcirculares, obovados, oblongos, glaucos, verdosos	obovados, verde claro opacos, con manchas purpúreas bajo las aréolas	ovados a obovados, verde claro grisáceos, opacos	anchamente obovados, verde pálido amarillento grisáceos	obovados, piriformes o subcirculares, verde pálidos, glaucos
Epidermis	ligeramente pubescente, tricomas cortos, unicelulares	pubescente, tricomas cortos, unicelulares	pubescente, tricomas cónicos, falcados, pluricelulares	pubescente, tricomas falcados, unicelulares	pubescente, tricomas falcados, muy largos, unicelulares
Series de aréolas	16 a 18	7 a 10(a 12)	18 a 20	16 a 17	15 a 16
Aréolas	elípticas, con fieltro blanco; pelos cerdosos ausentes	subcirculares, obovadas a piriformes, con fieltro moreno amarillento pasando a negro; pelos cerdosos ausentes	circulares a obovadas, con fieltro marrón claro, rodeado de un anillo blanco; pelos cerdosos 1 o 2, retorcidos, hasta 1 cm	circulares, con fieltro grisáceo; pelos cerdosos ausentes	circulares, con fieltro amarillento rodeado de un anillo negro; pelos cerdosos ausentes
Glóquidas	amarillas, dispuestas en la parte superior de la aréola	amarillo claras, dispuestas en la parte superior de la aréola	amarillas, dispuestas en la parte superior de la aréola	amarillas, dispuestas en los bordes y parte superior de la aréola	amarillentas, dispuestas en la parte superior de la aréola
Espinas	en todas las aréolas, 5 o 6, de 0.7–1.6 cm, emergen de la base y parte lateral de la aréola, las inferiores reflejas, divergentes, las laterales horizontales, blancas con base y ápice amarillo	ausentes en las aréolas inferiores, 2 a 3 o 4 a 5 en cladodios viejos, de 5–20 mm, con la edad hasta 3.5 cm, emergen del centro de la aréola, aciculares, divergentes o reflejas, a menudo torcidas, blancas, moteadas a grisáceas	en todas las aréolas, 3 a 7, la mediana más larga, hasta 3 cm, emergen de la parte inferior de la aréola, aciculares, aplanadas, flexibles, cerdosas, dobladas en la base, amarillentas con la punta translúcida, pasando a blanca con la edad	en todas las aréolas, 2 a 3(a 5), de 5–10 mm, setosas, casi blancas, con el ápice amarillento	en todas las aréolas (0)1 a 4, hasta 1.5 cm, aciculares, blanquecinas, la base y ápice amarillentos o pajizos
Flores (color y tamaño)	amarillas con la base verde, 7.5–8 cm	al principio verdoso anaranjadas después rosadas, 7–8 cm	amarillo verdosas, con manchas rojizas, 5–8 cm	amarillas, 5 cm	amarillo brillanteligeramente verdosas, pasando al segundo día a color salmón, 6.5 cm

Cuadro 1. Continúa.

	Opuntia gallegiana Scheinvar & Olalde	*O. guilianchi* Griffiths	*O. leucotricha* DC.	*O. oligacantha* C. F. Först.*	*O. spinulifera* Salm-Dyck
Pericarpelo	obovado, 4.5 × 2.9–3.5 cm, amarillo pálido pulverulento, aréolas 2–3 mm, obovadas, dispuestas en 6 o 7 series, con fieltro blanco-grisáceo prominente, formando un anillo a su alrededor, glóquidas amarillas dispuestas en la parte superior de la aréola, espinas 1 a 6, en algunas aréolas superiores, aciculares, porrectas, de 0.7–1.6 cm, blancas con la base y ápice amarillos	tuberculado, verde grisáceo, areolas dispuestas en 7 series, con fieltro marrón rojizo, glóquidas rojizas, dispuestas en la parte central de la aréola, sin espinas, con cerdas cortas amarillo rojizas	anchamente obovado, no tuberculado, 3 × 2.5 cm, verde oscuro, areolas dispuestas en 8 series, con fieltro amarillo verdoso, prominente, glóquidas amarillas en la parte central de la aréola, numerosas cerdas amarillo verdosas encorvadas porrectas, las superiores ascendentes	obcónico, ca. 2.5 × 2 cm, pubescente, verde pálido a amarillento, aréolas dispuestas en 7 a 8 series, con lana prominente, amarilla; glóquidas amarillas, desiguales, cerdas hasta 1 cm	obovado, tubérculos no prominentes, de 3 × 3.5 cm, verde claros, aréolas dispuestas en 8 series, con fieltro blanco amarillento, pelos setosos numerosos, 2 cm, blanquecinos y amarillentos, ondulados
Segmentos exteriores	deltoides, a cortamente espatulados, apiculados, bordes superiores dentados, los primeros rojos pasando a verdes con el ápice rojo, la base verde	deltoides, apiculados, bordes dentados, verdosos con tintes anaranjados	oblongos pasando a obovados con el ápice apiculado, amarillo verdosos con tintes rojizos	crasos, los primeros angostamente deltoides, largamente acuminados, apiculados, bordes laciniados, delgados, de color verde oscuro	verde amarillentos con amplia banda mediana castaña
Segmentos interiores	espatulados, ápice apiculado, amarillo claro con la base verde, base pedunculada, bordes superiores dentados	espatulados, ápice apiculado, margen dentado, anaranjados, al segundo día rojos	obovados a espatulados, ápice mucronado, de amarillos con estría verdosa	obovados a espatulados, acuminados, bordes finamente dentados, enteros en la base, blanco amarillentos a amarillo pardos con la base cuneada	amarillos brillantes ligeramente verdosos, pasando al segundo día a color salmón
Estambres	filamentos amarillos, anteras sagitadas blancas, conniventes sobre el estilo	filamentos anaranjados con la base rojiza, anteras amarillas	filamentos blancos a amarillo verdosos y anteras amarillo pálido	filamentos blancos, aplanados, recubiertos de papilas, anteras sagitadas blancas	filamentos y anteras amarillos
Carpelos	estilo rosado, lóbulos del estigma 8, verdes, conniventes	estilo anaranjado, lóbulos del estigma 10, amarillos, cara interior verde, paralelos entre sí	estilo rojo o blanco verdoso, lóbulos del estigma 6 a 10, emergentes, verde esmeralda	estilo rojo, lóbulos del estigma 8, emergentes verdes	estilo amarillo claro a verdoso, 11 a 16 lóbulos del estigma del mismo color

Cuadro 1. Continúa.

	Opuntia gallegiana Scheinvar & Olalde	*O. guilianchi* Griffiths	*O. leucotricha* DC.	*O. oligacantha* C. F. Först.*	*O. spinulifera* Salm-Dyck
Pollen	heptagonal, tectado, reticulado, ca. 83.3 µm, poros 12 a 16, muros glabros	hexagonal, periporado, reticulado, ca. 102.22 µm, poros 16, muros glabros	hexagonal, periporado, semitectado, suprareticulado, ± 4.5 µm, poros 15, muros glabros	poligonal, periporado, semitectado, supra-reticulado, de 72(−76)–80 µm, poros ca. 20, amplios, muros verrucosos	hexagonal, semitectado, periporado, suprareticulado, 7–16 µm, poros 12, muros glabros
Frutos	obovados a subglobosos, 4.5 × 3.5 cm, verdeamarillentos teñidos de color de rosa, 6 series de aréolas, sin espinas, paredes interiores anchas, amarillas, ácidas, extracto de las paredes del fruto rosa rojizo	subglobosos, 4 cm diám., generalmente amarillos, pero con frecuencia con la base color rojo anaranjado, con brillo; 6 series de aréolas, sin espinas, con notorias glóquidas amarillas, paredes interiores anchas, ácidas	obovados, 4–6 cm diám., durazno (rosado) o verde amarillento, 10 series de aréolas, sin espinas, cerdas o pelos, glóquidas amarillas, paredes interiores anchas, ácidas	piriformes, obovados o globosos, ca. 4.5 cm de largo y 3.5–4 cm diám., verde claros, amarillogrisáceos o purpúreos, siete series de aréolas, sin espinas, glóquidas amarillas, caducas, paredes interiores anchas, ácidas	globosos a subglobosos, ca. 3 cm diám., verde claro grisáceos, 8 series de aréolas, con pelos setosos ondulados, abundantes, paredes interiores anchas, blanco verdosas, ácidas
Semilla	discoide, con arilo lateral muy delgado	lenticular poliédrica, con arilo lateral angosto, regular	elipsoide, con arilo lateral ancho, regular, con tricomas en la superficie	obovada, con arilo lateral angosto, irregular	lenticular, irregularmente angulada, con arilo lateral muy angosto, irregular

* Sensu Scheinvar; taxonomía poco conocida.

aprovechan sus frutos. En el Cuadro 1 se comparan las características de esta nueva especie con otras tres simpátricas, todas productoras de xoconostles con tricomas en la epidermis.

Opuntia gallegiana Scheinvar & Olalde, sp. nov. TIPO: Zacatecas. Mpio. Sain Alto. Loc. Arroyo Hondo, Ganadería Lívia, 23°33′97″N, 103°11′95.7″W, *L. Scheinvar 7719, con G. Olalde & A. M. Pérez* (holotipo, MEXU; isotipos, ARIZ, CHAP, MO). Figuras 1, 2.

Diagnóstico. The new species is similar to the sympatric species *Opuntia guilanchae* Griffiths, *O. leucotricha* DC., *O. oligacantha* C. F. Först., and *O. spinulifera* Salm-Dyck by the trichomes on the epidermis of the cladodes, but differs from them by the following characters: cladodes subcircular, obovate to obovate-oblong, glaucous pale green; areoles disposed in 16 to 18 series; spines (3)5–6 on all areoles, emerging from the base and sides of areoles, the inferior spines reflexed and the lateral horizontal, white with an amber base and apex; flowers pale yellow to greenish yellow; pericarpel with areoles with a white-felted border; spines 1 to 6 at a few upper areoles, acicular, porrect, 0.7–1.6 cm; glochids yellow, disposed at the top of the areole; the first external segments red, the others green with a red apex; internal segments clear, pale yellowish, at the base greenish; filaments yellow, anthers white; style pink, stigma lobes 8, green, connivent; fruits pink, obovate to subglobose, without spines; outer walls thin, with 6 series of areoles; inner walls thick, rose-red; floral scar slightly sunken; seeds located in the center of the fruit with dry rose-colored funiculi (xoconostle).

Plantas arbóreas, hasta 4 m de alto; tronco de 25–30 × 90 cm, con corteza escamosa, negruzca, aréolas escasas con haces de cortas espinas cerdosas; la primera ramificación leñosa paralela al suelo. Cladodios subcirculares, obovados a obovado-oblongos, 19.5–23 × 14–15 cm, color verde pálido glauco; epidermis ligeramente pubescente, con tricomas unicelulares, cortos, cónicos, encorvados; estomas paracíticos, protegidos por un pliegue, hundidos; aréolas dispuestas en 16 a 18 series con 11 a 12 aréolas por serie; elípticas, con fieltro blanco y glóquidas amarillas, dispuestas en la parte superior de la aréola, 2.5 mm, deciduas; espinas (3)5 o 6, en todas las aréolas, dispuestas en la parte inferior y lateral de las aréolas, reflejas las inferiores y horizontales las laterales, aciculares, rectas, ápice retrobarbado con barbas adpresas, largas, parte medial con células oblongas paralelas entre sí (Figs. 2B, C), emergen de la parte inferior y lateral de la aréola, reflejas, divergentes, de 0.6–1.6 cm, blancas con la base y el ápice ambarinos. Flores abren al medio día o 11 a.m. y cierran en la tarde, 7.5–8 × 4.6 × 7.8 cm; pericarpelo obovado, 4.5 × 2.9–3.5 cm, amarillo pálido-verdoso, pulverulento, aréolas 2–3 mm, obovadas, dispuestas en 6 o 7 series, con fieltro blanco-grisáceo en los bordes, formando un anillo a su alrededor; glóquidas amarillas dispuestas en la parte superior de la aréola, espinas 1 a 6, en algunas aréolas superiores, aciculares, porrectas, de 0.7–1.6 cm, blancas con la base y ápice amarillos; segmentos exteriores del perianto deltoides a cortamente espatulados, apiculados, bordes superiores dentados, los primeros rojos pasando a verdes con el ápice rojo, la base verde; segmentos interiores 3.5–4 × 2 cm, amarillo claro con la base verde, espatulados, apiculados, base pedunculada, bordes superiores dentados; filamentos amarillos, anteras sagitadas, blancas, conniventes sobre el estilo; estilo rosado, lóbulos del estigma 8, verdes, conniventes. Granos de polen heptagonales, tectados, reticulados, ca. 83.3 µm, poros 12 a 16, muros glabros. Frutos obovados a subglobosos, 4.5 × 3.5 cm, verde-amarillentos teñidos de color de rosa, con 6 series de aréolas, paredes exteriores delgadas, sin espinas, las interiores gruesas, amarillas, ácidas, jugo color de rosa; cicatriz floral 2.1 cm diám., 8 mm de profundidad, con un anillo blanco-rosado a su alrededor; semillas discoides, con arilo lateral muy delgado, dispuestas en el centro del fruto, con funículos secos, rosados.

Distribución y hábitat. Se trata de una especie de Zacatecas, endémica de Sain Alto, abundante en las nopaleras del Municipio Sain Alto, Zacatecas, introducida en la Colección Nacional de Nopales Silvestres Mexicanos del Jardín Botánico del IB-UNAM y en el Depositario Nacional de *Opuntia* de Secretaría de Agricultura, Ganadería, Desarrollo Rural, pesca y Alimentación-Sistema Nacional de Recursos Fitogenéticos para la Alimentación y la Agricultura (SAGARPA-SINAREFI) y Centro Regional de la Universidad Autónoma Chapingo, El Orito, Zacatecas. Ejemplares de herbario fueron enviados a MEXU, con duplicados para CHAPA, ARIZ y MO.

Tipo de vegetación y especies asociadas. El tipo de vegetación es un matorral xerófilo (Rzedowski, 1978), de los pocos relictos del Gran Tunal, donde predominan nopales del género *Opuntia* Mill., asociada con las siguientes especies productoras de xoconostles: *O. guilanchi* Griffiths, *O. leucotricha* DC., *O. oligacantha* C. F. Först. (sensu Scheinvar, taxonomía poco conocida) y *O. spinulifera* Salm-Dyck. Las características distintivas entre las especies referidas se observan en el Cuadro 1.

IUCN Red List category. Puede ser considerada, según la IUCN Red List of Threatened Species (IUCN, 2001) como Vulnerable (VU) con alto riesgo de extinción y de distribución restringida (hasta

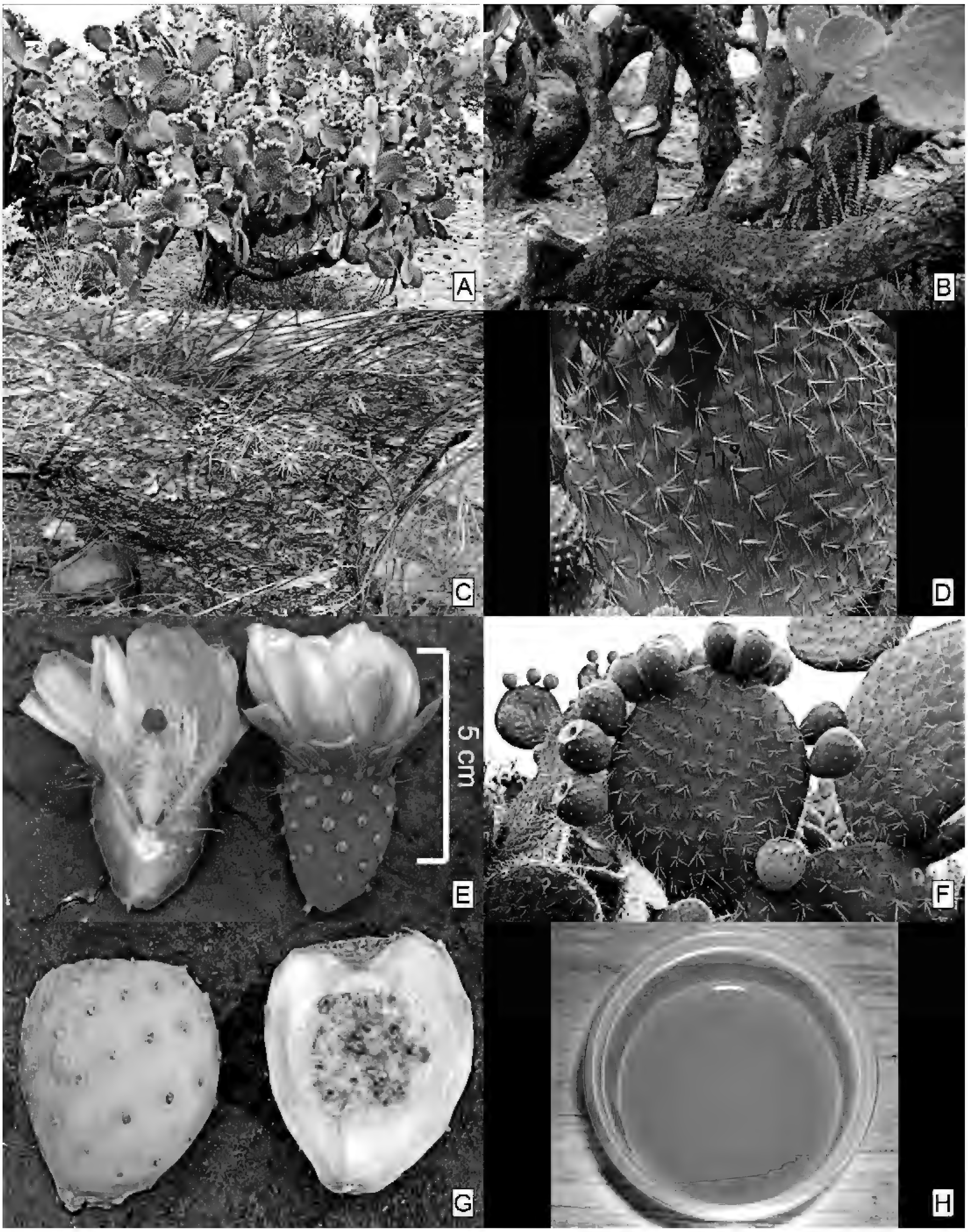


Figura 1. *Opuntia gallegiana* Scheinvar & Olalde. —A. Hábito en su hábitat. —B. Primera rama leñosa paralela al suelo. —C. Haz de espinas cerdosas blancas en el tronco. —D. Cladodio con espinas en todas las aréolas, dispuestas en la parte inferior y lateral de la aréola. —E. Flor, corte longitudinal, vista interior y exterior. —F. Frutos maduros y verdes. —G. Corte longitudinal de un fruto, vista interior, paredes anchas, verdes. Funículos secos, xoconostle. —H. Extracto rosa rojizo de las paredes del xoconostle. Fotos de los tipos tomados de *Scheinvar et al. 7719*, de Saín Alto, Zacatecas, México.

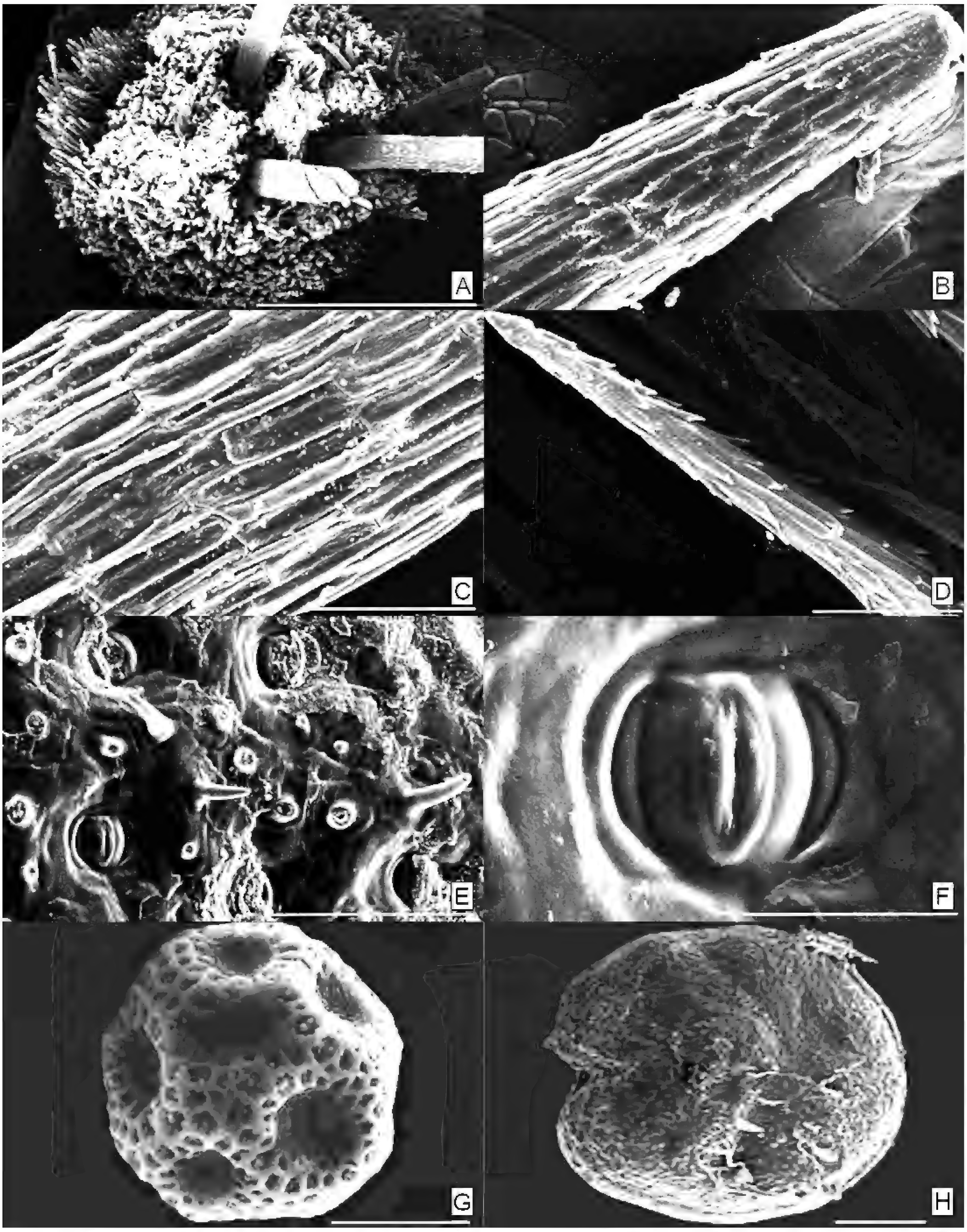


Figura 2. *Opuntia gallegiana* Scheinvar & Olalde. —A. Aréola con fieltro, glóquidas en la parte superior y base de espinas aplanadas (×25). —B. Parte apical de una espina (×40). —C. Parte media de una espina (×50). —D. Glóquida (×350). —E. Epidermis con tricomas unicelulares, cortos, cónicos, encorvados (×1000). —F. Estomas hundidos, paracíticos, protegidos por un pliegue (×250). —G. Grano de polen con 12 poros, muros verrucosos (×700). —H. Semilla lenticular, con anillo lateral muy delgado, región hilo micropilar poco profunda (×20). Micrografías tomadas por Berenith Mendoza Garfias y Dulce Ordóñez, MEB, IB-UNAM.

donde se conoce), por los cambios climáticos y distintas actividades antropogénicas, principalmente agrícolas en el área.

Etimología. El nombre de esta especie está dedicado al Ingeniero agrónomo Dr. Clemente Gallegos, investigador de la Universidad Autónoma Chapingo, dedicado al estudio de los nopales mexicanos, silvestres y cultivados, productores de tunas y de xoconostles.

Nombres vernáculos. Sardo, zardo y xoconostle.

Usos comunes. *Opuntia gallegiana* produce xoconostles, con el extracto de las paredes del fruto rosa rojizo. El pH de las paredes varía entre 4.03 y 4.57 y el de los funículos entre 2.04 y 4.45.

Serie a la cual pertenece. Se trata de una especie arbórea, la epidermis con tricomas unicelulares, cortos, encorvados y con frutos ácidos, xoconostles, por lo que la incluimos en *Opuntia* serie *Leucotrichae* DC.

Agradecimientos. Agradecemos al Jardín Botánico del Instituto de Biología de la Universidad Nacional Autónoma de México (UNAM) por su apoyo en la realización de la presente investigación. Agradecemos el apoyo económico de Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA)–Sistema Nacional de Recursos Fitogenéticos para la Alimentación y la Agricultura (SINAREFI) que permitió realizar las salidas de campo para elaborar este estudio en Zacatecas. A Cesar Ramiro Martínez González por su colaboración en la preparación de las muestras a ser examinadas bajo el microscopio electrónico de barrido y sacar algunas de las fotos del hábito y frutos de esta especie. También a Berenit Mendoza y Dulce Ordoñez, quienes tomaron y editaron las fotografías bajo el microscopio electrónico de barrido del Instituto de Biología, UNAM, respectivamente.

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Apéndice 1. Dieciocho especies silvestres productoras de xoconostles.

O. chavena Griffiths
O. chiangiana Scheinvar & Manzanero
O. durangensis Britton & Rose
O. elizondoana E. Sánchez & Villaseñor
O. gallegiana Scheinvar & Olalde
O. guilanchi Griffiths
O. heliabravoana Scheinvar
O. joconostle F. A. C. Weber
O. leucotricha DC.
O. matudae Scheinvar
O. oligacantha C. F. Först. (usage sensu Scheinvar, taxonomía poco conocida)
O. olmeca Joel Pérez, J Reyes & Brachet
O. parviclada S. Gama & S. Arias
O. scheeri F. A. C. Weber
O. spinulifera Salm-Dyck
O. tehuacana S. Arias & U. Guzmán
O. tezontepecana Gallegos-Vázquez & Scheinvar
O. zamudioi Scheinvar

Studies in Andean *Ocotea* (Lauraceae) III. Species with Hermaphroditic Flowers and Moderately Pubescent or Glabrous Leaves Occurring Above 1000 m in Altitude

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Abstract. This is the third and last installment of a treatment of Andean *Ocotea* Aubl. (Lauraceae) species with hermaphroditic flowers and covers species with solid stems and moderately pubescent or glabrous leaves. Eighteen species treated are new to science: *O. choquetangensis* van der Werff, *O. smithii* van der Werff, and *O. solomonii* van der Werff from Bolivia, *O. fusagasugensis* van der Werff and *O. hammeliana* van der Werff from Colombia, *O. condorensis* van der Werff, *O. limiticola* van der Werff, *O. longipetiolata* van der Werff, and *O. pichinchensis* van der Werff from Ecuador, *O. alveata* van der Werff, *O. caesifolia* van der Werff, *O. cuscoensis* van der Werff, *O. gymnoblasta* van der Werff, *O. latipetiolata* van der Werff, and *O. mollivillosa* van der Werff from Peru, and *O. cuspidata* van der Werff, *O. vergelensis* van der Werff, and *O. pedanomischa* van der Werff from Ecuador and Peru. The well-known name *O. helicterifolia* (Meisn.) Hemsl. is placed in synonymy of *O. macrophylla* Kunth. Lectotypes are designated for *O. albida* Mez & Rusby, *O. piurensis* Mez, and *O. veraguensis* (Meisn.) Mez [= *Sassafridium veraguense* Meisn.].

Key words: Andes, Bolivia, Colombia, Ecuador, IUCN Red List, Lauraceae, *Ocotea*, Peru, Venezuela.

This is the third part of a treatment of the Andean *Ocotea* species that occur above 1000 m, and it includes the species with hermaphroditic flowers, solid twigs, and glabrous to moderately pubescent leaves. In two earlier articles, species with fistulose twigs (van der Werff, 2012) and species with solid twigs and densely pubescent leaves (van der Werff, 2013a) were treated. *Ocotea* Aubl. is the largest genus of Lauraceae in the Neotropics with an estimated 350 to 400 species. The most recent treatment of the Neotropical species of *Ocotea*, including the Andean species, was published by Mez (1889), and a sizeable number of species have been described since then. The largest contribution since Mez was an overview of the entire genus largely based on a study of the type specimens by Rohwer (1986). The large size of the genus makes a revision of the entire group beyond the scope of most botanists. Details about floristic studies of *Ocotea* and a survey of historical collectors in the Andean region can be found in van der Werff (2012). The number of species in the Andean regions of Venezuela, Colombia, Ecuador, Peru, and Bolivia is more manageable, but remains considerable, and is estimated at 100. I have divided the Andean *Ocotea* species in recognizable, morphologically defined groups and published separate accounts of each species group.

Ocotea is characterized by flowers with six equal tepals, nine 4-locular stamens with the locelli arranged in two rows, a lack of staminodia or, when present, stipitiform staminodia and a fruit that is seated in a shallow to deep cupule. Flowers are hermaphroditic or unisexual; species with unisexual flowers are dioecious. Papillose hairs on the tepals (except in *Ocotea* subg. *Dendrodaphne* (Beurl.) Mez) or greatly enlarged glands at the base of the inner stamens, characters that are present in the related genera *Nectandra* Rottb. and *Pleurothyrium* Nees, are lacking. Although most species of *Ocotea* are found in the Neotropics, the genus is also present in Africa, Madagascar (van der Werff, 2013b), and a single species is found in the Canary Islands. Relationships within the genus are not entirely clear. Chanderbali et al. (2001) published a phylogeny of Neotropical Lauraceae and found that *Ocotea* in the currently accepted sense is not monophyletic. The sampling of this study was relatively small (24 species out of a total of 350 to 400) but showed that *Ocotea* included at least six clades well separated from each other in the phylogeny. The largest clade, with 10 species in the study, consisted of all species with unisexual flowers and included the type species of the genus, *O. guianensis* Aubl. The species with hermaphroditic flowers are divided among the remaining five clades. *Ocotea* subg. *Dendrodaphne*, consisting of perhaps six species and represented by two species in the phylogeny, formed one clade. Morphologically, this subgenus is distinctive due to the presence of

papillose hairs on the inner surface of the tepals, and the presence of papillae on the anthers, with the connective forming a sterile tip on the anthers and deep cupules with a double margin. It is represented by one species in the Andean region (*O. veraguensis* (Meisn.) Mez); the other species occur at lower altitudes from Mexico south to Ecuador. A third clade consists of the *O. insularis* group and includes about 16 species mostly in Central America (van der Werff, 2002) but with two species extending into northern South America. This group was represented in the phylogeny only by *O. insularis* (Meisn.) Mez ranging from Costa Rica to Ecuador. Characteristic of this group are the erect tepals at anthesis, stamens of the inner whorl with a patch of hairs at the junction of the filament, and associated anther on the side facing the ovary and the flattened branches of the inflorescence. A fourth clade consists of the *O. helicterifolia* (Meisn.) Hemsl. group and includes 30 to 35 species (Rohwer, 1991; van der Werff, 1999) widespread in Central America and with at least two species extending into northern South America. Characteristic of this group are the relatively large flowers with spreading tepals and tongue-shaped stamens with very short filaments and often with a sterile tip. Cupules have a single margin. About half the species have a typical indument consisting of long, soft, and erect hairs on the lower leaf surface. The two species of this group in the Andean region have this kind of pubescence. Three species of this group are included in the phylogeny (Chanderbali et al., 2001). A fifth clade is represented by two South American species in the phylogeny. However, the number of South American *Ocotea* species with hermaphroditic flowers that do not fit in the clades discussed above is rather large; the Andean region alone has about 50 such species. These species show morphologically a great deal of variation, and it seems unlikely, based on the morphology, that they form a monophyletic group. For a better understanding of the relationships in this group of species a phylogenetic analysis with a much larger number of samples is required.

In the phylogeny of Chanderbali et al. (2001) the *Ocotea* species with hermaphroditic flowers and those with unisexual flowers belong in different clades; none of the *Ocotea* clades consist of species mixed for breeding system, with unisexual and hermaphroditic flowers both within a single clade/group. In the staminate flowers of species with unisexual flowers the pistillode is reduced and threadlike or absent altogether, while in the pistillate flowers the staminodia are small with the locelli not or scarcely visible and not opening, and the stigma is raised above the level of the staminodia. In such instances, a single collection with mature flowers is sufficient to determine that the species has unisexual flowers.

Recently published keys to *Ocotea* species reflect the division between species with unisexual and those with bisexual flowers (Rohwer, 1986; van der Werff, 1999, 2002). However, the distinction between unisexual and bisexual flowers is less obvious in some cases. In those species the pistillate flowers are clearly recognizable as such, but the flowers with pollen-producing stamens have a pistillode (pistil) with a well-developed stigma and a swollen ovary. Rohwer (1986) suggested that some of these species (his *O. minarum* group) were gynodioecious, having both pistillate and bisexual flowers. In two other species (*O. insignis* Mez and *O. calophylla* Mez), he described the staminate flowers as having a thickened ovary and listed them as dioecious. The *O. minarum* group forms a seemingly homogeneous group of about 16 species characterized by its apparently gynodioecious flowers, the small, disklike cupules, the frequent presence of domatia, and the long, slender terminal buds. Several of these species were known to Mez (1889). He described four species of this group as having hermaphroditic flowers (*O. cuneifolia* (Ruiz & Pav.) Mez, *O. ovalifolia* (Ruiz & Pav.) Mez, *O. odorata* (Meisn.) Mez, and *O. frondosa* (Meisn.) Mez). However, all four were known from only one or two collections. Three species were recognized as dioecious with only pistillate flowers known (*O. obovata* (Ruiz & Pav.) Mez, *O. oblonga* (Meisn.) Mez, and *O. verruculosa* (Meisn.) Mez), and two species as dioecious with both pistillate and staminate flowers known (*O. daphnifolia* (Meisn.) Mez and *O. minarum* (Nees & Mart.) Mez). Mez (1889: 306, 307) noted that the pistillode in the staminate flowers of the last two species was well developed (for *O. daphnifolia*, "gynaecium primo intuito bene quidem evolutum"; for *O. minarum*, "ovarium primo adspectu haud male evolutum"). Mez (1889: 299) described the flowers of *O. calophylla* as unisexual or possibly hermaphroditic (Flores dioici [an hermaphroditi?]); however, Meissner (1864) described this species as *Pleurothyrium velutinum* and considered the flowers hermaphroditic. Thus, while there was little doubt that the pistillate flowers of this group are unisexual, it was not clear if the other flower type was hermaphroditic or staminate. An answer to this question is not likely to be found by examining herbarium specimens. Field studies are needed to determine if trees with staminate and/or hermaphroditic flowers set seed, in which case they are hermaphroditic, or if not, then staminate. A few collections of species with these

so-called gynodioecious flowers had young fruits with remnants of the floral parts (for instance, *Monteagudo et al. 6433*, MO). Because these collections had staminodia, not stamens, at the base of the fruits, I consider the so-called hermaphroditic flowers of gynodioecious species to be staminate and will include these species in the treatment of the other dioecious species. This group consists of the *O. minarum* group sensu Rohwer (1986) and *O. smithiana* O. C. Schmidt and related species. The *O. minarum* group can be recognized by its slender terminal buds, very small, platelike cupules, the presence of domatia, and a denser indument on the inner tepals than on the outer ones. The *O. smithiana* group can be recognized by its thick twigs, flowers with spreading tepals and relatively large (2 mm) stamens, and shortly petioled or subsessile leaves. Its twigs often have a light color, with narrow lenticels on the bark surface. Its species can vary from densely pubescent as in *O. calophylla* Mez to glabrous as in *O. smithiana*.

Key to the Species of Andean *Ocotea* with Hermaphroditic Flowers, Solid Twigs, and Lacking a Dense Pubescence

1a. Twigs and vegetative buds glabrous (vegetative buds may have a fringe of hairs or some hairs at the base) 2
1b. Twigs and/or vegetative buds variously and homogeneously pubescent 4
2a. Leaf bases inrolled and decurrent on the petiole; leaves 15–30 cm long ... 12. *O. gymnoblasta* van der Werff
2b. Leaf bases flat, not decurrent on the petiole; leaves < 10 cm long 3
3a. Leaves chartaceous, with deep pocket domatia, these visible on the upper surface ..... 3. *O. alveata* van der Werff
3b. Leaves coriaceous, pocket domatia absent, but domatia present as axillary tufts of hairs on the lower leaf surface ..... 28. *O. solomonii* van der Werff
4a. Lower leaf surfaces with erect pubescence 5
4b. Lower leaf surfaces with appressed pubescence or glabrous 9
5a. Lower leaf surfaces glaucous; domatia usually present, as small pits but often partly obscured by curly hairs ..... 4. *O. caesifolia* van der Werff
5b. Lower leaf surfaces not glaucous; domatia lacking 6
6a. Receptacles pubescent on the inner surface; leaf bases angustate; tertiary venation raised on the lower surface, scalariform ..... 23. *O. pacifica* van der Werff
6b. Receptacles glabrous inside; leaf base acute or obtuse; tertiary venation when raised reticulate, not scalariform 7
7a. Leaves to 4 cm wide ..... 20. *O. mollivillosa* van der Werff
7b. Leaves more than 5 cm wide 8
8a. Pubescence on the twigs consisting of short, matted hairs, covering the surface of the twigs completely ..... 29. *O. valerioana* (Standl.) W. C. Burger
8b. Pubescence on the twigs consisting of straight, erect hairs ca. 0.5 mm long, the surface partially visible between the hairs ..... 19. *O. macrophylla* Kunth
9a. Domatia present on the lower leaf surface, as tufts of hairs, small pits or slits in the axils of secondary veins or along the secondary veins 10
9b. Domatia absent 13
10a. Filaments of inner stamens glabrous or uniformly and sparsely pubescent; branchlets of inflorescences terete; flowers glabrous or sparsely pubescent outside 11
10b. Filaments of the inner stamens dorsally with a patch of white hairs at the junction of anther and filament; branchlets of inflorescences flattened; flowers sparsely to densely pubescent outside 12
11a. Twigs of flowering shoots densely pubescent, the surface almost entirely covered; reticulation immersed on the lower surface; pedicels 3–6 mm long ..... 21. *O. monzonensis* Mez
11b. Twigs of flowering shoots sparsely pubescent, the surface clearly visible; reticulation raised on the lower surface; pedicels to 2 mm long ..... 22. *O. munacensis* O. C. Schmidt
12a. Leaves 8–27 × 5–14 cm, flowers sparsely to densely grey pubescent; fruits to 2 cm long ..... 15. *O. insularis* (Meisn.) Mez
12b. Leaves 5–15 × 2–6 cm, flowers densely white pubescent; fruits to 4.5 cm long ..... 33. *O. whitei* Woodson
13a. Receptacle pubescent inside 14
13b. Receptacle glabrous inside 22
14a. Petioles flat above or petioles < 6 mm long ... 15
14b. Petioles canaliculate above and 9 mm or longer 17
15a. Mature leaves 20–30 cm long; petioles 5–8 mm wide ... 16. *O. latipetiolata* van der Werff

15b. Mature leaves < 15 cm long; petioles ca. 2 mm wide 16
16a. Tepals 2 mm long; cupules deeply cup-shaped, to 20 mm wide ..... 6. *O. choquetangensis* van der Werff
16b. Tepals to 1.4 mm long; cupules funnel-shaped or cup-shaped; if cup-shaped, to 11 mm diam. ..... 24. *O. pedanomischa* van der Werff
17a. Stamens tongue-shaped, with a very short and thick filament, the anther with a distinct sterile tip; stamens papillose ..... 30. *O. veraguensis* (Meisn.) Mez
17b. Stamens with a distinct filament, not tongue-shaped, without a sterile tip, glabrous or with some hairs, stamens pubescent or glabrous, not papillose 18
18a. Flowers subsessile or with pedicels shorter than the flowers 19
18b. Flowers pedicellate, the pedicels as long as or longer than the flowers 20
19a. Leaves pale green or glaucous below; leaf bases flat or the slightly revolute; petioles 9–14 mm ..... 2. *O. albida* Mez & Rusby
19b. Leaves dark green below; leaf bases revolute, sometimes shortly decurrent on petioles; petioles 16–26 mm ..... 25. *O. pichinchensis* van der Werff
20a. Tepals densely pubescent on the outer surface and spreading at anthesis ..... 1. *O. aciphylla* (Nees & Mart.) Mez
20b. Tepals sparsely pubescent on the outer surface and half-erect at anthesis 21
21a. Leaves acuminate, to 14 × 4.5 cm, the distal leaves often subopposite; base of lamina decurrent on the petiole ..... 10. *O. cuspidata* van der Werff
21b. Leaves acute, to 23 × 10 cm, the distal leaves alternate; leaf base obtuse, not decurrent ..... 31. *O. vergelensis* van der Werff
22a. Inflorescences in the axils of bracts along leafless short shoots or at the tip of branches 23
22b. Inflorescences in the axils of leaves 24
23a. Leaves 10–17 × 4–9 cm, inflorescences 5–12 cm long ..... 26. *O. piurensis* Mez
23b. Leaves 3–9 × 1.2–3 cm, inflorescences 1–3 cm long ..... 32. *O. weberbaueri* Mez
24a. Flowers and hypanthium glabrous ..... 5. *O. celastroides* (Meisn.) Mez
24b. Flowers and hypanthium pubescent 25
25a. Leaves tripliveined, secondary veins 3 or 4 on each side ..... 11. *O. fusagasugensis* van der Werff
25b. Leaves pinnately veined; secondary veins more than 5 on each side 26
26a. Leaf bases decurrent on the petiole, acute or angustate 27
26b. Leaf bases not decurrent on the petiole, acute, obtuse or rounded 30
27a. Flowers sessile or nearly so; pedicels, if present, shorter than the flowers; secondary veins immersed on the upper surface and immersed or weakly raised on the lower surface 28
27b. Flowers distinctly pedicellate; pedicels as long as or longer than the flowers; secondary veins impressed on the upper surface and strongly raised on the lower surface ..... 13. *O. hammeliana* van der Werff
28a. Inner three stamens dorsally with a tuft of hairs at the junction of filament and anther ..... 15. *O. insularis* (Meisn.) Mez
28b. Filaments of the inner three stamens glabrous or with a few evenly distributed hairs 29
29a. Flowers densely pubescent; twigs strongly angled ..... 27. *O. smithii* van der Werff
29b. Flowers sparsely pubescent; twigs terete or weakly angled ..... 18. *O. longipetiolata* van der Werff
30a. Secondary veins on the upper leaf surface impressed 31
30b. Secondary veins on the upper leaf surface immersed ... 33
31a. Pubescence on twigs consisting of very short (0.1–0.2 mm) brown or gray hairs 32
31b. Pubescence on twigs consisting of longer (to 1 mm) pale yellow-brown hairs ..... 7. *O. comata* van der Werff

32a. Tepals 1–1.3 mm; petioles flat above ... . 17. *O. limiticola* van der Werff
32b. Tepals 2–3 mm; petioles canaliculate above .... 14. *O. heterochroma* Mez & Sodiro
33a. Petioles flat above 34
33b. Petioles canaliculate or < 0.5 cm 35
34a. Leaves widest above the middle, the tips acute; petioles 5–8 mm ..... 9. *O. cuscoensis* van der Werff
34b. Leaves widest at or below the middle, the tips acuminate; petioles 10–14 mm .... 8. *O. condorensis* van der Werff
35a. Hairs on lower leaf surface 0.5–1 mm long, appressed or ascending, distally often twisted together ... 7. *O. comata*
35b. Hairs on the lower leaf surface to 0.2 mm long, appressed, distally free or leaves glabrous 36
36a. Leaves falcate, conduplicate, 3–9 × 1.2–3 cm, inflorescences 1–3 cm long ..... 32. *O. weberbaueri*
36b. Leaves flat, 7–15 × 2.4–7.5 cm; inflorescences to 14 cm long 37
37a. Connective of anthers prolonged beyond the locelli, anther apiculate; pedicels as long as or longer than the tepals; apex of leaves acuminate ..... 1. *O. aciphylla*
37b. Connective of anthers not prolonged, anthers with obtuse or rounded tip; pedicels shorter than the tepals; apex of leaves acute or obtuse ..... 14. *O. heterochroma*

Taxonomic Treatment

1. Ocotea aciphylla (Nees & Mart.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 243. 1889. Basionym: *Oreodaphne aciphylla* Nees & Mart., Linnaea 8: 43. 1833. TYPE: Brazil. Brasilia meridionalis, *F. Sellow 766* (lectotype, B [barcode] 100185131, digital image; isolectotype, GZU not seen).

Trees, to 25 m; twigs terete or slightly angular, 2–3 mm diam., solid, moderately to densely appressed pubescent, terminal buds densely appressed pubescent. Leaves 7–15 × 2.4–5.5 cm, alternate, stiffly chartaceous to coriaceous, elliptic to oblong, rarely somewhat obovate, base obtuse to shortly decurrent with a recurved base, margin flat or somewhat revolute, apex acuminate, acumen to 1.5 cm, less frequently acute, venation immersed on upper surface and poorly visible, midrib raised, lateral veins and tertiary largely immersed on lower surface, domatia lacking, upper leaf surface glabrous, lower surface moderately to densely appressed pubescent, surface appearing sericeous, lateral veins 5 to 7 on each side, 2 basal ones closer together than more distal ones, petioles 5–12 mm, deeply canaliculate, with a similar pubescence as the twigs. Inflorescences in axils of leaves or bracts, to 9 cm long, densely appressed pubescent, paniculate cymose. Flowers white, rarely yellow, 3–7 mm diam., outer surface densely pubescent and largely covered by the indument; tepals ovate, 1.5–2.7 mm long, densely pubescent on both surfaces, spreading; stamens 9, all 4-celled, the outer six 1.2 mm, anther glabrous, about as long as pubescent filament, the locelli introrse, occupying entire anther or connective prolonged beyond the locelli and anther apiculate, inner 3 stamens ca. 1 mm, pubescent filament half as long as anther, staminodia 0.5 mm, stipitiform, pubescent, pistil glabrous, style as long as ovary, receptacle cup-shaped, pubescent or glabrous inside. Fruits ellipsoid, 3 × 1.5 cm, cupule deeply cup-shaped, 1.2 cm high, 2 cm diam.

Discussion. *Ocotea aciphylla* is widespread in South America, ranging from Colombia (*Cogollo et al. 5154*, MO) to southern Brazil. It is frequently collected in lowland forests, but occurs also at altitudes above 1000 m in Venezuelan Guayana, the Araca Mountains in Brazil (*Amaral 1577*, MO), and in the Andean countries. Often highland populations look different from the lowland plants and several names have been proposed for such populations in Venezuelan Guayana. Recent collections from the Andean region show the same tendency; for instance, specimens from Cajamarca in northern Peru have a denser indument, wider leaves with an obtuse base, and larger fruits. However, there is so much variation in pubescence density and leaf characters over its total range that it seems unwise to give taxonomic recognition to these higher altitude forms of *O. aciphylla*.

Ocotea aciphylla is best recognized by the combination of the following characters: appressed, somewhat shiny indument on the lower leaf surface, distinctly canaliculate petioles, basal pair of lateral veins closer together than the more distal veins, tepals pubescent on both surfaces, and deeply cup-shaped cupules.

Initially I had identified specimens with a glabrous receptacle, slightly larger flowers (6–7 mm vs. 3–5 mm diam.), and apiculate (not rounded) anthers as *Ocotea rhynchophylla* (Meisn.) Mez, a species with the type from Guyana. However, I found a specimen from lowland Peru (*Morawetz & Wallnofer 11–24985*, MO) with larger flowers and a pubescent receptacle

and a specimen from Guyana (*Hahn 5825*, MO) with larger flowers and a pubescent receptacle, and it seems best to treat *O. aciphylla* as a variable, widespread species until a revision of this group can be made. Rohwer (1986) previously treated 10 species as synonyms of *O. aciphylla*.

Distribution. *Ocotea aciphylla* is distributed from the lowlands to 2000 m in Ecuador, Peru, and Bolivia.

Phenology. The species flowers in October and November.

Selected specimens examined. BOLIVIA. **La Paz:** Bautista Saavedra, ANMI Apolobamba, *Fuentes et al. 7443* (MO). ECUADOR. **Zamora-Chinchipe:** along rd. Guayzimin to Chinapintza thru Pachicutza, *van der Werff et al. 19577* (MO); Estacion Cient. San Francisco, *Homeier 530* (MO). PERU. **Cajamarca:** San Ignacio, Selva Andina, *Huamán & Vargas 27* (MO); San Martin, Rioja, 1 km E de Aguas Verdes, *Sanchez-Vega et al. 9910* (MO).

2. Ocotea albida Mez & Rusby, Mem. Torrey Bot. Club 6: 114. 1896. TYPE: Bolivia, Mapiri, July–Aug. 1892, *M. Bang 1550* (lectotype, here designated, NY [barcode] 00355568).

Trees, 10 m; twigs angular to terete, 2–5 mm diam., sparsely to densely appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 7–17 × 2.5–8 cm, alternate, elliptic, firmly chartaceous to coriaceous, base acute to obtuse, margin at times slightly inrolled near base, apex acute, rarely obtuse, upper surface glabrous, lower surface sparsely appressed pubescent, covered with a waxy deposit and appearing pale green in sicco, venation immersed on upper surface, midrib raised, secondary veins slightly raised, tertiary venation immersed or barely raised on lower surface; secondary veins 6 to 9 on each side; domatia absent; petioles 9–15 mm, canaliculate, with same indument as twigs. Inflorescences 4–13 cm, paniculate cymose, mostly in axils of bracts, rarely in axils of leaves, moderately to densely appressed pubescent; pedicels lacking and flowers sessile or infrequently pedicels to 1 mm. Flowers greenish yellow, 2–5 mm diam., outer surface moderately to densely pubescent, tepals half-erect, 1.2–2.2 mm, inner surface sparsely pubescent, stamens 9, all 4-locular, outer six 0.6–1.2 mm, pubescent filament 0.1–0.4 mm, inner 3 stamens 0.7–1.3 mm, filament 0.1–0.5 mm, glands present at base of inner stamens, staminodia present, 0.2–0.4 mm, stipitiform, pubescent, pistil 1.3–2 mm, glabrous, slender ovary about twice as long as style, receptacle deep, densely pubescent inside. Fruits to 3.1 × 2.1 cm, cupules fully enclosing the young fruits (to 1 cm diam.), at maturity cupules bowl-shaped to shallowly cup-shaped, 2.5 cm diam., 1.3 cm high, without remnants of tepals.

Discussion. *Ocotea albida* is best recognized by its pale green to glaucous lower leaf surface and the mostly sessile flowers. As accepted here, it shows considerable variation in flower size (from 2.2 to 5 mm diam., with corresponding variation in size of tepals, stamens, and staminodia) and fruit size (from 2 to 3.1 cm). These quantitative differences are not large enough to recognize more than one taxon.

In the original 1896 description by Mez and Rusby, two collections were cited, *Bang 1550* and *Bang 1646*. Because no type collection was designated, all duplicates of these two collections were syntypes. Subsequently Rusby realized that the two collections represented different species and described *Ocotea proboscidea* Rusby in 1907 with *Bang 1646* as its only representative. By inference, *O. albida* was restricted to the several specimens of *Bang 1550*, but Rusby did not designate a lectotype among them. The label data of nearly all specimens of *Bang 1550* gives July–August 1892 as the collection date and lists Mapiri as collection locality. One sheet in NY of *Bang 1550* (barcode 00355569) was collected on the Bolivian Plateau in 1891; this sheet has flowers, fruits, and cupules. Obviously, not all specimens of *Bang 1550* came from a single gathering since they were collected on different dates at different localities. In order to avoid future confusion, I designate the NY sheet with barcode 00355568 as lectotype. This specimen, with good flowers, has been annotated by Caroline Allen and Jens Rohwer as an isotype or syntype. Other sheets for *Bang 1550* are known from A, B, F, G, GH, K, LE, M, MO, MICH, and NY.

The original description of *Ocotea albida* by Mez and Rusby was based on specimens of two species and did not accurately describe *O. albida* in the currently accepted sense. For instance, Mez and Rusby attributed dioecious flowers to *O. albida*, although this species has hermaphroditic flowers. Likewise, I did not see stalked glands at the base of the inner stamens; the glands are sessile, as is usual in *Ocotea*. The pistil in the dissected flowers was quite slender, but in older flowers the style is clearly lighter in color than the ovary, suggesting that the pistil is functional.

Distribution. *Ocotea albida* is known in altitudinal range from 850 to 2500 m.

Phenology. The species is noted as flowering in September, October, and November.

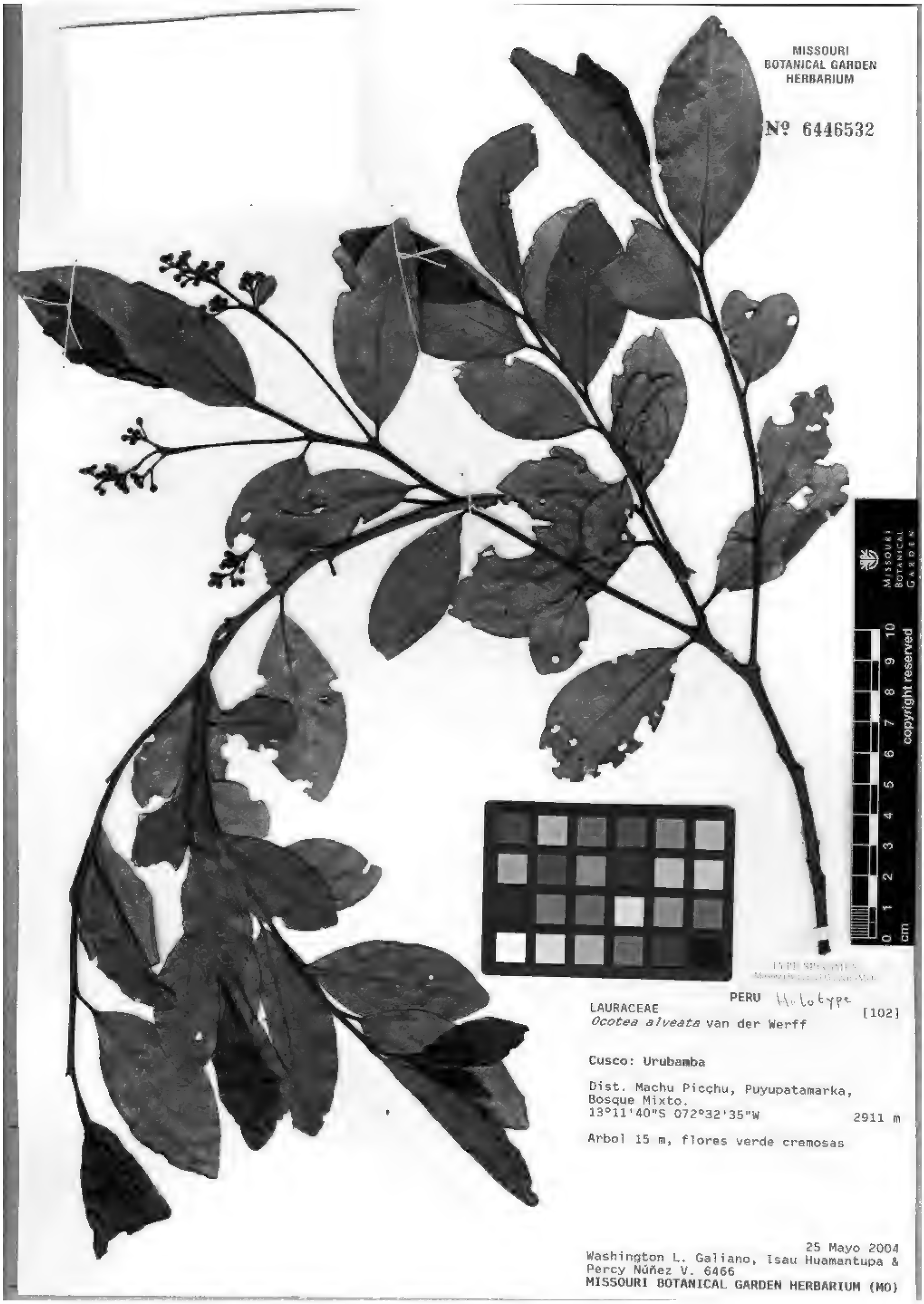


Figure 1. Holotype of *Ocotea alveata* van der Werff (*W. Galiano, I. Huamantupa & P. Nuñez 6466*, MO).

Selected specimens examined. BOLIVIA. **La Paz:** Franz Tamayo, Parque Nac. Madidi, Keara, 14°36′59″S, 68°57′14″W, 2400 m, 8 Nov. 2007, *A. Araujo-Murakami et al. 3622* (MO). PERU. **Cusco:** La Convención, Distr. Quellouno, Yavero, 12°28′32″S, 72°28′53″W, 2123–2500 m, 28 Sep. 2006, *L. Valenzuela et al. 7833* (MO).

3. Ocotea alveata van der Werff, sp. nov. TYPE: Peru. Cusco, Urubamba, Distr. Machu Picchu, Puyupatamarka, 13°11′40″S, 72°32′35″W, 2911 m, 25 May 2004, *W. Galiano, I. Huamantupa & P. Nuñez 6466* (holotype,

MO-6446532; isotypes, CUZ not seen, US). Figure 1.

A congeneris floribus hermaphroditis, gemmis foliisque glabris et foliis domatiis profundis praeditis recedit.

Tree, 15 m; twigs terete or angular, 3 mm diam., glabrous; terminal buds glabrous. Leaves 5–8 × 2.2–3.2 cm, alternate, elliptic, chartaceous, base acute to obtuse, apex bluntly acute, margin flat, glabrous, venation weakly raised on upper surface, more pronouncedly raised on lower surface, tertiary venation reticulate, domatia present on some leaves as deep slitlike cavities ca. 1.5 mm long, visible as small bumps, secondary veins 4 to 6 on each side, petioles 4–6 mm, flat above, glabrous. Inflorescences 7–9 cm, in axils of leaves, paniculate cymose, mostly glabrous but distally sparsely pubescent, a bractlike leaf 1 cm long present at the base of the lowermost branch of the inflorescence. Flowers pale green, 2–2.5 mm diam., glabrous, tepals erect, 1.4 × 1.2 mm, outer surface glabrous, inner surface with a few hairs near base, minutely papillose in distal half, stamens (not fully mature in type) 9, all 4-locular, sessile or nearly so, 0.8 mm, glabrous, inner 3 stamens with lateral locelli, outer stamens quadrate, almost as wide as long, glands present at base of the inner stamens, staminodia not seen, pistil 1.3 mm, glabrous, ovary gradually narrowed in thick style, stigma disklike, receptacle cup-shaped, glabrous inside. Fruit and cupule unknown.

Discussion. Although *Ocotea alveata* is only known from the type collection and the collection has only immature flowers, it is described here because the combination of bisexual flowers, glabrous leaves and vegetative buds, and conspicuous slit or pocket domatia sets it apart from all other *Ocotea* species. The small papillae on the distal half of the inner surface of the tepals is also an unusual characteristic among *Ocotea* species. I cannot suggest a close relative of this new species.

IUCN Red List category. Since this new species is only known from the type collection, it is given the status of Data Deficient (DD), according to IUCN (2001) criteria.

4. Ocotea caesifolia van der Werff, sp. nov. TYPE: Peru. Cusco: La Convención, Distr. Santa Teresa, cerro Yerbabuenayoc, 13°07′35″S, 72°36′52″W, 2400 m, 23 Mar. 2004, *I. Huamantupa & A. Huamantupa 4354* (holotype, MO-6446538; isotype, CUZ not seen). Figure 2.

A congeneris floribus hermaphroditis, foliis abaxialiter glaucis nervis secundariis in axillis foveolis pilosis instructis et indumento ramulorum foliorumque erecto recedit.

Trees, to 16 m; twigs terete, 4 mm diam., densely reddish brown to brown pubescent, the indument consisting of very short, curly hairs and longer, erect hairs; terminal buds completely covered by densely reddish brown pubescence. Leaves 4.5–8 × 1.7–4 cm, alternate, subcoriaceous, elliptic-obovate or obovate, base acute or obtuse, margin flat, apex acute to obtuse, upper surface moderately densely pubescent, hairs erect, shorter, curly hairs also present, indument denser on major veins, wearing off with age, lower surface glaucous, sparsely to moderately pubescent with erect hairs and shorter, curly hairs, pubescence much denser on major veins, venation slightly raised on upper surface, tertiary venation reticulate, midrib and secondary veins raised, tertiary venation slightly raised on the lower surface, domatia present in axils of secondary veins as small pits, 0.2–0.3 mm diam., largely hidden by pubescence and difficult to see, secondary veins 7 to 11 on each side, petioles 3–5 mm, and leaves subsessile, flat above, with similar indument as twigs. Inflorescence (one seen) 7 cm, in a leaf axil, basal lateral branches with 3 cymes, reduced to 1 cyme or single flowers distally, densely pubescent, pedicels ca. 0.3 mm, flowers almost sessile. Flowers pale yellow, 5 mm diam., moderately pubescent, tepals 6, spreading, 1.8 mm, pubescent on both surfaces, stamens 9, all 4-locular, outer six 1.2 mm, filament 0.2 mm, a few hairs dorsally at base of anther, locelli opening introrse, inner 3 stamens 1.3 mm, dorsally with some hairs near base, filament 0.2 mm, globose glands present at base of inner stamens, staminodia not seen, pistil 1.5 mm, glabrous, style as long as ovary, stigma platelike, receptacle deeply cup-shaped, glabrous inside. Fruits and cupules unknown.

Discussion. *Ocotea caesifolia* is a very distinctive species with glaucous, obovate, subsessile leaves, bisexual flowers, pit domatia, and erect pubescence. Its relationships within the genus are not clear. Small pit domatia also occur in *O. oblonga*, a species with unisexual flowers, and pit domatia are rare among Andean *Ocotea* species with bisexual flowers. Subsessile, obovate leaves and large anthers are found in the species related to *O. smithiana* O. C. Schmidt, but these species have unisexual flowers. The ovary in *O. caesifolia* is well developed, the stigma is large and platelike, and pollen can be seen in some of the locelli, so it appears that *O. caesifolia* has bisexual flowers. Although the labels of two paratypes mention



Figure 2. Holotype of *Ocotea caesifolia* van der Werff (*I. Huamantupa & A. Huamantupa 4354*, MO).

the presence of fruits, no fruits were found on the specimen at MO.

Phenology. The single flowering collection representing the type was made in March.

Habitat and distribution. The new species is known only from the type location in Cusco, Peru, at 2400–2700 m.

IUCN Red List category. This species is known from three collections made at a single locality and is

assessed as Data Deficient (DD), according to IUCN (2001) criteria.

Paratypes. PERU. **Cusco:** La Convención, Distr. Santa Teresa, subida a Yerbabuanayoc, 13°04′S, 72°22′W, 2420 m, 17 Sep. 2005, *I. Huamantupa, N. Anaya, M. Callalli, J. Tito & L. Vargas 6667* (AMAZ not seen, B, CUZ not seen, F, HUT not seen, MO, MOL not seen, NY, USM not seen), La Convención, Distr. Santa Teresa, Urpipata, 13°04′S, 72°22′W, 2700 m, 18 Sep. 2005, *I Huamantupa, N. Anaya, M. Callalli, J. Tito & L. Vargas 6781* (CUZ not seen, MO).

5. Ocotea celastroides (Meisn.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 275. 1889. Basionym: *Oreodaphne celastroides* Meisn., DC. Prodr. 15: 126. 1864. TYPE: Colombia. Sierra Nevada de Santa Marta, s.d., *Purdie s.n.* (holotype, K [barcode] K000575091).

Tree or shrub of unknown size; twigs terete, 2 mm diam., appressed pubescent when young but very quickly becoming glabrous, terminal buds densely appressed pubescent. Leaves 3–7 × 1–2 cm, alternate or somewhat clustered near tips of branches, coriaceous, narrowly elliptic to lanceolate, bases acute, margin flat or a little revolute, apices acute, glabrous, venation immersed on upper surface, raised on lower surface and tertiary venation reticulate; secondary veins 6 to 8 on each side, petioles 3–8 mm, slightly canaliculate, with a similar indument as twigs. Inflorescences ca. 5 cm, glabrous, in axils of bracts, few-flowered, racemose or distally with 1 or 2 cymes, pedicels 4–6 mm. Flowers 3 mm diam., glabrous outside, tepals erect at anthesis, pubescent on inner surface, stamens 9, all 4-locular, filaments with a few hairs, about as long as anthers, glands present at base of inner stamens, staminodia present, sparsely pubescent, pistil glabrous, receptacle cup-shaped, glabrous inside. Fruits and cupules not known.

Discussion. *Ocotea celastroides* is only known from the holotype at K. It is adequately defined by the combination of hermaphroditic, glabrous flowers, few-flowered inflorescences, and narrowly elliptic to lanceolate, glabrous leaves. The description is brief and largely taken from Mez (1889) and the 1984 drawing of a floral dissection (stamens, staminode, ovary) by Rohwer that is attached to the Kew sheet. I did not dissect a flower; the number of flowers on the type is limited and little would be gained from destroying yet another flower. Floral details are not necessary for the identification; the largely vegetative characters given above are sufficient for identification. The type is densely leafy. The leaves cover the bases of most inflorescences and it is not possible to verify if the inflorescences are borne in the axils of leaves and bracts or only in the axils of bracts. It is not known at what altitude the type was collected. According to Mez (1889) the type was collected in Venezuela, which is an error. Meissner (1864) indicated that the type was collected in Colombia, which corresponds to the type's original label.

6. Ocotea choquetangensis van der Werff, sp. nov. TYPE: Bolivia. La Paz, Prov. Inquisivi, comun. Choquetanga, 16°44′S, 67°20′W, 3310 m, 3 Mar. 1994, *N. Salinas 2521* (holotype, MO-5603942; isotypes, B, LPB not seen, MO-5091744). Figure 3.

Ocoteae pedanomischae van der Werff similis, sed tepalis majoribus, cupulis magnis profundis et tepalis partim persistentibus ad marginem cupularum recedit.

Tree, 13 m, diam. to 52 cm; twigs angular, 3–4 mm diam., densely appressed pubescent when young, indument wearing off with age; terminal buds densely appressed pubescent. Leaves 4–8 × 2–4 cm, alternate, coriaceous, elliptic to broadly elliptic, base rounded, margin often recurved, apex obtuse or acute, upper surface glabrous, lower surface moderately appressed pubescent, becoming glabrous with age, pale green in sicco, domatia absent, venation immersed on upper surface, tertiary venation not visible, midrib prominently raised, secondary veins raised and tertiary venation immersed on lower surface; secondary veins 5 to 8 on each side, petioles 4–5 mm, canaliculate, with a similar indument as twigs. Inflorescences 4–8 cm, in axils of leaves, moderately to sparsely appressed pubescent, paniculate cymose, branchlets angular, pedicels to 1 mm long, appressed pubescent. Flowers 4–4.5 mm diam., sparsely pubescent outside, tepals ca. 2 mm, initially half-erect, but spreading in older flowers, inner surface pubescent, stamens 9, all 4-locular, outer 6 stamens 1 mm, filament pubescent, 0.4 mm, inner 3 stamens 1.2 mm, pubescent filaments 0.8 mm, glands present at base of inner stamens, staminodia stipitiform 0.5 mm, pubescent, pistil glabrous, 2 mm, style as long as ovary, receptacle deep, densely pubescent inside. Fruits ellipsoid, ca. 1.5 × 1 cm, included in cupule for half their length, cupules deeply cup-shaped, to 1.5 cm long and 2.1 cm diam., tepals partially persisting as small lobes on the cupules.

Discussion. *Ocotea choquetangensis* is similar to *O. pedanomischa* van der Werff, but differs in having larger tepals (2 mm vs. 1.2 mm long), deeply cup-shaped cupules (vs. funnel-shaped cupules), partially persisting tepals on the cupules, and pale green lower leaf surfaces (vs. darker green leaf surface). The pale



Figure 3. Holotype of *Ocotea choquetangensis* van der Werff (*N. Salinas 2521*, MO).

green color of the lower leaf surface suggests that this species had a glaucous, waxy leaf surface, a character that is lost when specimens are conserved in alcohol. Flower characters suggest that the new species is part of the *O. aciphylla* group, which are well represented in the Andes. The new species shares with *O. pedanomischa* the short (5–6 mm) petioles. The type collection had been previously identified as *Ocotea* aff. *albida* Mez & Rusby, and duplicates may have been distributed under that name. However, *O. albida* has

longer petioles (10 mm or more), and stiffly chartaceous (not coriaceous) leaves to 14 cm long.

Common name. The name of tasaque was recorded from one of the two collections (*Salinas 2697*, MO).

Distribution. Only known from Bolivia, the altitudinal distribution of *Ocotea choquetangensis* ranges from 3290 to 3310 m.

Phenology. Both known collections of the new species had flowers and fruits in March.

IUCN Red List category. This species is known from two collections from similar/nearby localities and is therefore assessed as Data Deficient (DD), according to IUCN (2001) criteria.

Paratype. BOLIVIA. **La Paz:** Prov. Inquisivi, comun. Choquetanga-Wichupampa, serranias de Lulini, 16°45′S, 67°20′W, 3290 m, 17 Mar. 1994, *N. Salinas 2697* (F, MO).

7. Ocotea comata van der Werff, Novon 22: 343. 2013. TYPE: Bolivia. La Paz, Franz Tamayo, Parque Nac. Madidi, Sect. Santa Ana, 25 June 2009, *A. F. Fuentes, J. Salas & R. Huasurco 14843* (holotype, LPB; isotypes, B, BOLV, MO, USZ).

This species was included among the taxa with the lower leaf surface completely covered by the indument (van der Werff, 2013). However, in some specimens the indument is not as dense and the leaf surface is partly visible (especially on old leaves). For this reason, the species is also included herein. A description and specimen citations can be found in the publication cited above.

8. Ocotea condorensis van der Werff, sp. nov. TYPE: Ecuador. Morona-Santiago: Limón Indanza, Cumbre del Cerro Chikichiki Naint, 4 km al sur este del Centro Shuar Warints, 03°10′13″S, 78°14′33″W, 1220 m, 9 Oct. 2002, *G. Toasa 8952* (holotype, MO-6446535; isotypes, B, NY, QCNE not seen, US). Figure 4.

Inter species hermaphroditas petiolis planis praeditas haec species foliis chartaceis acuminatis, floribus parvis et petiolis 10–14 mm longis distinguitur.

Tree, 18 m; twigs terete, 2–3 mm diam., densely and minutely appressed pubescent; terminal buds densely appressed pubescent. Leaves 9–14 × 4–6 cm, alternate, chartaceous, elliptic, base obtuse or acute, margin plane, apex acute or acuminate, acumen to 1 cm long, but apices often damaged and leaves appearing acute, upper surface glabrous, lower surface glabrous or with a few appressed hairs, domatia absent, venation immersed or slightly raised on the upper surface, midrib prominently raised, secondary veins raised and tertiary venation slightly raised and loosely reticulate on lower surface, gland dots faintly visible on lower surface; secondary veins 5 to 7 on each side, distally arching upward and becoming loop-connected; petioles 10–14 × 0.1–0.2 mm, flat above, with a similar indument as twigs. Inflorescences 3–7 cm, in axils of leaves, moderately to densely appressed pubescent, paniculate cymose, lateral branchlets somewhat flattened, pedicels to 1.2 mm, densely pubescent. Flowers white, 2.5 mm diam., receptacle appressed pubescent outside, tepals 1 mm, spreading to reflexed, outer surface sparsely puberulous, inner surface with 2 lengthwise lines of hairs, these connected distally, otherwise glabrous, stamens 9, all 4-locular, glabrous, 0.5 mm, filament 0.1 m, glands present at base of inner 3 stamens, staminodia 0.2 mm, with a few hairs, tip somewhat flattened, pistil 1 mm, glabrous, style half as long as ovary, receptacle cup-shaped, glabrous inside. Fruit and cupule not known.

Discussion. *Ocotea condorensis* is best recognized by the combination of the following characters: small, hermaphroditic flowers, chartaceous and often acuminate leaves (in most leaves seen on the type collection the apices are damaged and the leaves appear acute), with flat, rather narrow petioles 10 mm or longer. The relationships of the new species are not clear; the flattened petioles place it outside the *O. aciphylla* group. The flattened inflorescence branchlets suggest an affinity to the *O. insularis group*, but the absence of hairs on the filaments of the inner 3 stamens argue against this relationship.

Habitat and distribution. The habitat for the single collection from Ecuador is described as low forest with an abundance of *Sphagnum* L. on the ground layer, suggesting that the substrate is derived from nutrient poor sandstone.

IUCN Red List category. Because this species is only known from the type collection, it is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

9. Ocotea cuscoensis van der Werff, sp. nov. TYPE: Peru. Cusco: Paucartambo, Kosñipata, Trocha Union, Km. 10, 2295 m, 13 Sep. 2003, *J. E. Silva, M. Mamani, W. Huaraca, A. R. Davila & T. Boza 631* (holotype, MO-6446534; isotypes, CUZ not seen, USM not seen). Figure 5.



Figure 4. Holotype of *Ocotea condorensis* van der Werff (*G. Toasa 8952*, MO).

Ocoteae heterochromae Mez & Sodiro similis, sed ab ea petiolis planis, foliis glandulis immersis adaxialiter praeditis, tepalis minoribus et staminibus staminodiisque glabris recedit.

Small tree of unknown height; twigs terete or somewhat angular, 2–3 mm diam., sparsely to moderately pubescent with very short hairs; terminal buds densely pubescent. Leaves 6–12 × 3–5 cm, alternate, firmly chartaceous, slightly obovate or elliptic to broadly elliptic, base obtuse or infrequently acute, margin plane, apex acute or shortly acuminate,



Figure 5. Holotype of *Ocotea cuscoensis* van der Werff (*J. E. Silva, M. Mamani, W. Huaraca, A. R. Davila & T. Boza 631*, MO).

glabrous, venation immersed on upper surface, midrib and secondary veins raised, tertiary venation weakly raised on lower surface, gland dots visible on upper surface, less so on older leaves, domatia absent, secondary veins 5 or 6 on each side, petioles 5–8 mm, flat above, with similar indument as twigs. Inflorescences in the axils of leaves, 3–5 cm, paniculate cymose, sparsely to moderately pubescent; pedicels ca. 1 mm, appressed pubescent. Flowers 2 mm diam., white, hypanthium and outer surface of tepals

moderately appressed pubescent, tepals half-erect at anthesis, 0.9 mm, pubescent on inner surface, margin somewhat papillose, deciduous in old flowers, stamens 9, all 4-locular, outer stamens 0.8 mm, glabrous, filament 0.3 mm, inner stamens 0.9 mm, glabrous, locelli lateral, glands present at base of inner stamens, staminodia stipitiform, 0.3 mm, glabrous; pistil 1.5 mm, glabrous, style 0.5 mm, receptacle funnel-shaped, glabrous inside. Fruit and cupule not known.

Discussion. At first glance, *Ocotea cuscoensis* can be confused with the variable *O. heterochroma*. Differences between the two species are flattened petioles (vs. canaliculate), glandular dots on the upper blade surface (vs. lack thereof), tepals 0.9 mm (vs. 2–3 mm), glabrous stamens and staminodes (vs. partially pubescent), and smaller inflorescences 3–5 cm (vs. 5–14 cm). The upper leaf surfaces of the new species are also somewhat lustrous.

IUCN Red List category. Because *Ocotea cuscoensis* is known from only three collections, of which two were made on the same day at the same location, it is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

Distribution. *Ocotea cuscoensis* was collected around 2300 m elevation.

Phenology. Flowering collections were made in August and September.

Paratypes. PERU. **Cusco:** Paucartambo, Kosñipata, Trocha Union, Km. 10, 2295 m, 28 Aug. 2003, *A. Davila, D. Galiano & V. Qquellon 30* (MO, CUZ not seen, USN not seen), 13 Sep. 2003, *J. Silva, M, Mamani, W. Huaraca, A. Davila & T. Boza 631A* (MO, CUZ not seen, USM not seen, WFU not seen).

10. Ocotea cuspidata van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Nangaritza Canton, Sendero desde Pachicutza hacia el "Hito," 04°07′S, 78°34′W, 1600–1800 m, 5 Dec. 1990, *W. Palacios & D. Neill 6544* (holotype, MO-6446536; isotypes, B, K, NY, P, QCNE not seen, US). Figure 6.

Ocoteae aciphyllae similis, sed tepalis sparse pubescentibus, erectis (nec patentibus), basi foliorum decurrenti recedit.

Small trees, to 10 m; twigs terete, 1–2 mm diam., slender, sparsely appressed pubescent; terminal buds densely appressed pubescent. Leaves 8–14 × 2–4.5 cm, chartaceous, alternate, but distal leaves often subopposite, elliptic to narrowly elliptic, base acute, margin inrolled and decurrent on petiole, apex acuminate, acumen ca. 1 cm, venation immersed on upper surface, midrib slightly raised, secondary and tertiary venation immersed on lower surface, upper surface glabrous, lower surface glabrous or with a few appressed hairs, secondary veins 6 to 8 on each side, but veins difficult to discern, domatia lacking, petioles 10–16 mm, canaliculate, with a similar indument as twigs. Inflorescences 3–8 cm, in axils of leaves, laxly flowered, racemose or branchlets with a single cyme, sparsely appressed pubescent, pedicels ca. 2.5 mm, appressed pubescent. Flowers yellow, 2.2 mm diam., hypanthium and tepals sparsely pubescent outside, tepals 1 mm, erect at anthesis, inner surface with a few appressed hairs, stamens 9, all 4-locular, outer 6 stamens 0.9 mm, filament 0.4 mm, with a few hairs, inner 3 stamens 0.8 mm, filaments 0.3 mm, with a few hairs; glands present at base of inner stamens, staminodia stipitiform, 0.2 mm, pubescent; pistil glabrous, style about as long as ovary, receptacle deep, pubescent inside. Fruits ellipsoid, 2.2 × 1.3 cm, cupules cup- or bowl-shaped, 1.8 cm diam., 1.3 cm high, with a simple margin.

Discussion. *Ocotea cuspidata* can be easily recognized by its slender twigs, subopposite leaves with the base decurrent on the petiole, and lax inflorescences. It resembles *O. vergelensis* van der Werff, another species from southern Ecuador, in its lax inflorescences, erect tepals, and sparse indument. However, *O. vergelensis* differs in its larger, wider leaves with acute, not acuminate, tips, and an obtuse base and thicker twigs. The more common *O. aciphylla* differs in having spreading, densely pubescent tepals and thicker twigs, and in lacking decurrent leaf bases.

The name *Ocotea cuspidata* Martius was cited by Nees (1836) in synonymy under *Nectandra cuspidata* Nees & Martius as a herbarium name used by Martius (*O. cuspidata* Martius in Herb. Bras. Monac.). The name was never validly published and the epithet is therefore available for the species described above.

Habitat and distribution. Several new species from southern Ecuador and northern Peru are restricted to nutrient-poor, sandstone-derived soils. Usually this substrate is mentioned on the labels. However, the labels of *O. cuspidata* only mention montane forest as habitat without further details of soil type, and it is therefore likely this species grows on more fertile soils. The new species has been collected at altitudes from 1500 to 2010 m.

IUCN Red List category. *Ocotea cuspidata* is known from six collections in southern Ecuador and northern Peru. As far as is known, it does not occur in



Figure 6. Holotype of *Ocotea cuspidata* van der Werff (*W. Palacios & D. Neill 6544*, MO).

protected areas. The label of the type collection mentioned that it was locally common. It does not seem that this species is seriously threatened, but given its limited distribution, it is given the assessment of Vulnerable (VU), based on IUCN (2001) criteria.

Phenology. *Ocotea cuspidata* has been collected with flowers in December and fruits in December and February.

Paratypes. ECUADOR. **Zamora-Chinchipe:** Nangaritza Canton, Sendero desde Pachicutza hacia el "Hito,"



Figure 7. Holotype of *Ocotea fusagasugensis* van der Werff (*D. Soejarto 366*, GH).

04°07′S, 78°34′W, 1600–1800 m, 5 Dec. 1990, W. *Palacios & D. Neill 6541* (MO); El Pangui, Cuenca del rio Tundaime, carretera hacia el destac. Militar Condor Mirador, 03°37′14″S, 78°26′36″W, 1500 m, 12 Dec. 2000, *M. Cerna, D. Neill & Grupo de Post-Grado 411* (MO); Nangaritza, Camp. Militar Pachicutza, camino al hito, 04°07′S, 78°54′W, 1849 m, 22 Feb. 1994, *M. Tirado 890* (MO). PERU. **Cajamarca:** San Ignacio, Buenos Aires del Parco, 05°04′38″S, 78°52′58″W, 2060 m, 11 Nov. 2000, *M. Huamán 41* (MO), 13 Nov 2000, *M. Huamán 43* (MO).

11. Ocotea fusagasugensis van der Werff, sp. nov. TYPE: Colombia. Cundinamarca: Fusagasuga, roadside betw. El Peñon & San Miguel, 2500 m, 9 Aug. 1963, *D. Soejarto 366* (holotype, GH; isotype, US). Figure 7.

Ocoteae stuebelii Mez affinis, sed ab ea foliis triplinervibus et receptaculis intus glabris recedit.

Small tree, to 4 m; twigs terete or slightly ridged, 3 mm diam., densely brown puberulous, surface largely covered; terminal buds densely puberulous with short, appressed hairs. Leaves 7–14 × 3.5–5.5 cm, alternate, firmly chartaceous, elliptic, base acute or obtuse, margin a little revolute, apex shortly acuminate, acumen to 1 cm, but sometimes broken off, upper surface glabrous, lower surface densely appressed pubescent or puberulous, surface partly visible, midrib and secondary veins impressed on upper surface and leaves somewhat bullate, tertiary venation immersed and not visible on upper surface, midrib and secondary veins prominently raised, tertiary venation weakly raised or immersed on lower surface, basal secondary veins more strongly developed than distal ones, domatia absent, secondary veins 3 to 4 on each side, petioles 6–13 mm, strongly canaliculate, with a similar indument as twigs. Inflorescences in axils of leaves, 4–8 cm, densely and minutely pubescent with ascending or erect hairs, paniculate cymose, pedicels 1.5–3 mm, densely pubescent. Flowers 3–4 mm diam., pale yellow, hypanthium densely pubescent, tepals 6, moderately to sparsely appressed pubescent, spreading at anthesis, 1.2 mm, inner surface moderately or sparsely pubescent, united near base; stamens 9, all 4-locular, 0.7 mm, filament 0.2 mm, pubescent, anther glabrous, glands present at base of inner stamens, pistil glabrous, 2 mm, ovary gradually narrowed in style, staminodia 0.4 mm, stipitiform, pubescent in lower half, receptacle cup-shaped, glabrous inside. Immature fruits largely enclosed in deep cupules, 3 mm exserted, cupules (immature) 13 mm diam., 9 mm high, margin entire.

Discussion. *Ocotea fusagasugensis* can be identified by the combination of tripliveined leaves that are densely puberulous with deeply canaliculate petioles and the glabrous inner surface of the receptacle. It is probably closely related to the poorly known *O. stuebelii* Mez, but that species differs in its pinnately veined leaves and a pubescent inner surface of the receptacle. Both species belong to the *O. aciphylla* group of Rohwer that is characterized by the pubescent inner surface of the tepals, the canaliculate petioles, a deep receptacle, and large cupule. *Ocotea fusagasugensis* is known from only two collections; once more collections are available, its relationship with *O. stuebelii* should be re-evaluated.

Habitat and distribution. *Ocotea fusagasugensis* has been collected in Colombia from 2530 to 2830 m.

IUCN Red List category. Because this species is only known from two collections, it is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

Phenology. The flowering collection was made in August, the fruiting collection in March.

Paratype. COLOMBIA. **Cundinamarca:** Mun. de Sibate, Alto de Cuchuco en la carretera Bogota-Fusagasuga, 2830 m, 18 Mar. 1974, *F. Sarmiento 335* (MO).

12. Ocotea gymnoblasta van der Werff, sp. nov. TYPE: Peru. Cusco: La Convención, distr. Santa Ana, Tunquimayo, 12°54′34″S, 72°48′36″W, 2000–2200 m, 20 Oct. 2002, *L. Valenzuela, E. Succli & I. Huamantupa 744* (holotype, MO-6446537; isotypes, AMAZ not seen, B, CUZ not seen, G, HUT not seen, US, USM not seen). Figure 8.

Ex affinitate *Ocoteae insularis* (Meisn.) Mez, sed ab ea gemmis vegetativis glabris et basi foliorum involuta distincta.

Trees to 15 m; twigs angular when young, soon becoming terete, 4–5 mm diam., glabrous, bark initially dark, becoming whitened with age; terminal buds glabrous. Leaves 20–40 × 6–16 cm, glabrous, alternate, chartaceous, elliptic to broadly elliptic or elliptic-obovate, base gradually narrowed and inrolled, apex obtuse to rounded, venation immersed on upper surface, midrib raised, secondary and tertiary veins not as strongly raised, domatia absent, secondary veins 7 to 11 on each side, petioles 1.5–2.7 cm, canaliculate, glabrous. Inflorescences 19–26 cm, in axils of leaves or bracts, glabrous, paniculate cymose, lateral branchlets flat. Flowers white, 3 mm diam., outside of receptacle glabrous; tepals erect to half-erect, 1.7 × 1.2 mm, outer 3 glabrous or nearly so on outer surface, inner 3 sparsely pubescent, inner surface sparsely pubescent; stamens 9, all 4-locular, outer 6 ca. 1.1 mm, filament short, 0.3 mm, inner 3 ca. 1 mm, glabrous except for a tuft of hairs adaxially at junction of filament and anther, small glands present at base of inner 3 stamens, staminodia not seen, pistil glabrous, 1.5–2 mm, stigma a small disk, ovary gradually narrowed in style, receptacle deep, glabrous inside. Fruit and cupules unknown.



Figure 8. Holotype of *Ocotea gymnoblasta* van der Werff (*L. Valenzuela, E. Succli & I. Huamantupa 744*, MO).

Discussion. The new species can be readily identified by the combination of bisexual flowers, glabrous vegetative buds, inrolled leaf base, flattened branches of the inflorescence and the tuft of hairs adaxially at the junction of filament and anther of the inner three stamens. The large leaves with obtuse to rounded apex is also distinctive. The flattened branches of the inflorescence, the hairs adaxially on the inner stamens, and the erect to half-erect tepals suggest a relationship of *Ocotea*



Figure 9. Holotype of *Ocotea hammeliana* van der Werff (*B. Hammel & A. Navaraez 17179*, MO).

gymnoblasta with the *O. insularis* group (van der Werff, 2002).

Distribution. *Ocotea gymnoblasta* has been collected in Peru at altitudes from 2000 to 2500 m.

IUCN Red List category. This species is only known from two recent collections made in Cusco, Peru, and is therefore given the assessment of Data Deficient (DD) based on IUCN (2001) criteria.

Phenology. The flowering collection was made in October.

Etymology. The specific epithet is derived from *gymnos* (naked) and *blastos* (bud, sprout) and refers to the glabrous vegetative buds.

Paratype. PERU. **Cusco:** La Convención, Distr. Santa Ana, Microcuenca Poromate, 12°56′12″S, 72°47′03″W, 2000–2500 m, 25 Sep. 2002, *L. Valenzuela, E. Succli, I. Huamantupa & F. Carazas 665* (MO).

13. Ocotea hammeliana van der Werff, sp. nov. TYPE: Colombia. Nariño: rd. from El Espino to Tumaco, 30 km from Ricaurte, 01°17′N, 78°07′W; 950 m, 9 Dec. 1988, *B. Hammel & A. Navaraez 17179* (holotype, MO-6446525; isotypes B, F, G, HBG, K, L, LE, MA, MO, NY, P, PE, QCA,US, USM). Figure 9.

A congeneris floribus hermaphroditis praeditis haec species foliis base decurrentibus revolutisque, nervis secundariis adaxialiter impressis, abaxialiter elevatis et venatione tertiaria scalariformi recedit.

Tree, 20 m; twigs angular, 4–6 mm diam., densely and minutely appressed pubescent when young, indument wearing off with age; terminal buds densely grey pubescent. Leaves 10–17 × 6–11 cm, alternate, coriaceous, broadly elliptic, base angustate and decurrent on petiole, margin revolute near base, apex rounded or obtuse, upper surface glabrous, glabrous or with a few appressed hairs on lower surface, midrib immersed, secondary veins impressed and tertiary venation slightly raised and scalariform on the upper surface, midrib and secondary veins prominently raised, tertiary venation slightly raised and scalariform on lower surface, domatia lacking, secondary veins 7 to 10 on each side, petioles 1–2 cm, flat above, glabrous or appressed pubescent when young. Inflorescences 10–20 cm, paniculate cymose, in axils of leaves or bracts, densely and minutely appressed pubescent; pedicels 10–14 mm. Flowers ca. 3 mm diam., sordid orange, hypanthium and outside of tepals densely or moderately pubescent, tepals 1 mm, spreading to half-erect at anthesis, inner surface of tepals pubescent, stamens 9, all 4-locular, 0.7 mm, glabrous or with a few hairs along filaments, glands present at base of inner stamens, staminodia present, triangular, 0.3 mm, pistil 1 mm, glabrous, the style 0.3 mm, receptacle cup-shaped, glabrous inside. Fruits and cupules not known.

Discussion. Distinctive for *Ocotea hammeliana* are the leaves with impressed secondary veins, scalariform tertiary venation, the decurrent, revolute leaf bases, and the obtuse or rounded leaf apices. Two collections from Ecuador are closely related or conspecific; both have the decurrent leaf bases with revolute margin, pedicellate flowers with the same floral structure, and in one case weakly scalariform tertiary venation. They differ in having the secondary veins immersed or weakly impressed, leaf apices sometimes acute and fewer lateral veins (five to nine). These collections are *Palacios 5639* (MO), a 40-m tree with buttresses from Canton El Chaco in Napo collected at 1300 m, and *Palacios et al. 8507* (MO), a 10-m tree from Canton Nangaritza in Zamora-Chinchipe at 970 m. These two collections differ from each other in minor vegetative characters and also from the type of *O. hammeliana*. These two collections can either be recognized as one or two new taxa very similar to *O. hammeliana* or treated as closely related to *O. hammeliana* without formal recognition as new taxa. I prefer the latter solution but realize that when more collections become available, they may be separated as new species. The two *Palacios* collections will be annotated as *Ocotea* aff. *hammeliana*.

IUCN Red List category. *Ocotea hammeliana* is only known from a single collection and is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

14. Ocotea heterochroma Mez & Sodiro, Bull. Herb. Boissier, Sér. 2, 5: 239. 1905. TYPE: Ecuador. "In silvis subandinis occidentalibus vulcani Tungurahua," *L. Sodiro 143/6b* (holotype, B).

This species was included among the taxa with the lower leaf surface completely covered by the indument (van der Werff, 2013). However, in some specimens the indument is not as dense and the leaf surface is partly visible or almost glabrous. Several collections from Colombia have leaves to 5 cm long and large fruits (to 4 × 3.2 cm) and cupules (3 cm diam., 2.5 cm high) (*Vargas 3000, 7969*, and *8861*, all at MO). However, other collections from the same area (*Cuatrecasas 20593*, *20410*, both US) have larger leaves, and the quantitative differences do not warrant recognition of a new species. The common name tuno (or laurel tuno) is mentioned on two collections (*Cuatrecasas 20593* and *Devia & Prado 1948*, both at MO) from the Colombian department of Valle del Cauca.

15. Ocotea insularis (Meisn.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 271. 1889. Basionym: *Phoebe insularis* Meisn., DC. Prodr. 15(1): 33. 1864. TYPE: Costa Rica. Cocos Island, *A. Menzies s.n.* (isotype, MO-247401).

Ocotea floccifera Mez & Sodiro, Bull. Herb. Boissier, Sér. 2, 5: 237. 1905. TYPE: Ecuador. Pichincha, *L. Sodiro 143/4* (holotype, B).

Trees, to 30 m; twigs angled or ridged, solid, occasionally fistulose, 3–5 mm diam., glabrous or appressed pubescent; terminal buds sparsely to densely appressed pubescent. Leaves 8–27 × 5–14 cm, alternate, chartaceous to coriaceous, elliptic or obovate, pinnately veined, base attenuate, infrequently inrolled and decurrent or shortly decurrent on petiole, margin plane, apex rounded to shortly acuminate, midrib, lateral veins and tertiary venation immersed or slightly raised on upper surface, slightly raised on lower surface, upper surface glabrous, lower surface glabrous or sparsely appressed pubescent, domatia consisting of tufts of hairs often present near axils of the lateral veins, lateral veins 6 to 10 on each side, petioles to 1.2 cm, flat or slightly canaliculate above, with same indument as the twigs. Inflorescences 8–20 cm, paniculate cymose, in axils of normal leaves, sparsely pubescent, pubescence becoming denser toward flowers, branches of the inflorescence flattened, pedicels 1–2 mm. Flowers 2–4 mm diam., greenish white or creamy; tepals 1–1.5 mm, ovate, densely to sparsely pubescent outside, less pubescent to glabrous on inner surface, erect to half-erect at anthesis, outer 6 stamens 0.6–1.4 mm, free filament half as long as anther, glabrous, cells opening introrse, inner 3 stamens 0.6–1.5 mm, filament half as long as anther, with a tuft of whitish hairs at transition of filament to anther, cells extrorse; staminodia seen in larger flowers, hidden between glands, stipitate, 0.3 mm; pistil 1.6 mm, glabrous, ovary about as long as style, receptacle bowl-shaped, glabrous inside. Fruit ellipsoid, 20 × 10 mm, cupule a shallow bowl, to 12 mm diam., with a single margin, tepals rarely persisting on cupule.

Discussion. *Ocotea insularis* is a variable species best recognized by its rather large leaves with a decurrent, sometimes inrolled leaf base, frequently rounded or obtuse leaf apices, small flowers with usually erect tepals, and tufts of hairs on the backs of the inner stamens. Most collections have flowers with diameters of 2–2.2 mm, but several collections from Ecuador have wider flowers with diameters of 4–4.5 mm. Other collections have intermediate sized flowers (3 mm diam.); also, of the two collections *Rubio & Quelal 582* and *593*, both at MO, collected on the same day and at the same locality, one had flowers 4 mm in diam. and the other flowers of 2 mm diam., suggesting that flower size in this case cannot be used to recognize another segregate species. A second variable is found in the leaf venation. Specimens may have the tertiary venation slightly raised on the upper surface, while in others the venation is immersed. Most specimens with raised tertiary venation have (broadly) elliptic leaves, while most specimens with immersed venation have obovate leaves. Among the specimens with raised venation, some have larger flowers, others smaller flowers. Variation also occurs in pedicel length; flowers can be nearly sessile or have pedicels longer than the flowers; among petiole length, with leaves sometimes subsessile or with a distinct petiole; occasionally specimens have fistulose twigs inhabited by ants; in a few specimens the tepals persist in fruit, although tepals usually fall off quickly after flowering, and finally there is some variation in the pubescence of the leaves and flowers. Because the variation in these various characters is not correlated, I accept here a broad taxonomic concept of *O. insularis*.

Several collections placed here in *Ocotea insularis* have been previously identified as *O. glaucosericea* Rohwer, *O. ira* Mez & Pittier, or *O. floccifera*, and duplicates may have been distributed with that identification. *Ocotea glaucosericea* is a species known from Costa Rica and Panama. It resembles the large-flowered form of *O. insularis* but differs in its leaf base, which is decurrent on the petiole and inrolled, as well as in its denser indument, and a deeper, cup-shaped cupule. *Ocotea floccifera* and *O. ira* are considered synonyms of *O. insularis*.

Common names. In Ecuador, common names include alpa Guayacan (*Palacios & Iguago 4847*, MO), canelon, canelon blanco, canelon negra (*Nicolalde et al. 1298*, *1377*, MO), malde (*Ortiz et al. 536*, MO), catza malde (*Tipaz et al. 1373*, MO), and malde teiug (*Tipaz et al. 1403*, MO). Two shuar names used in Morona-Santiago are yantanim (*Nicolalde* et *al. 1298*, MO) and mai numi (*Neill et al. 7474*, MO).

Distribution. *Ocotea insularis* occurs in Costa Rica, Panama, Colombia, and Ecuador.

Phenology. The species has been observed to flower and fruit throughout the year.

Selected specimens examined. COLOMBIA. **Antioquia:** *Cogollo et al. 4210* (MO); Quindio, *Vargas 3299* (MO). **Valle:** *Giraldo-Gensini & Agredo 209* (MO). ECUADOR. **Carchi:** *Mendez & Aulestia 384* (MO). **El Oro:** *Vargas et al. 5371* (MO). **Esmeraldas:** *Palacios 4352* (MO). **Imbabura:** *van der Werff et al. 12188* (MO). **Morona-Santiago:** *Neill 13223* (MO). **Napo:** *Palacios 6312* (MO). **Zamora-Chinchipe:** *Tirado & Gray 892* (MO).

16. Ocotea latipetiolata van der Werff, sp. nov. TYPE: Peru. Cajamarca: San Ignacio, Buenos



Figure 10. Holotype of *Ocotea latipetiolata* van der Werff (*M. Huamán, R. Vásquez, J. Campos, G. Calatayud & B. Cordova 37*, MO).

Aires del Parco Cerro, 05°04′38″S, 78°53′30″W, 2230 m, 9 Nov. 2000, *M. Huamán, R. Vásquez, J. Campos, G. Calatayud & B. Cordova 37* (holotype, MO-6446529; isotypes, B, F, K, NY, US, USM not seen). Figure 10.

A congeneris andinis foliis magnis glabris et petiolis latis planis recedit.

Trees, 10 m; twigs strongly angular, thick, 5–8 mm diam., initially minutely appressed pubescent, be-



Figure 11. Holotype of *Ocotea limiticola* van der Werff (*J. Caranqui, G. Pabon & Grupo de Post-Grado MO-QCNE 239*, MO).

coming glabrous with age; terminal buds densely and minutely appressed pubescent. Leaves 20–30 × 10–17 cm, alternate, firmly chartaceous, broadly elliptic, base shortly attenuate, margin flat, apex shortly acute or obtuse, glabrous on both surfaces, midrib and secondary veins slightly raised, tertiary venation immersed on upper surface, midrib and secondary veins raised, tertiary venation slightly raised on lower surface, domatia lacking, secondary veins 9 to 12 on each side, petioles 10–17 mm, flat above, 5–8 mm

wide. Inflorescences in axils of leaves or bracts, 7–12 cm, paniculate cymose, rather densely and minutely appressed pubescent; pedicels 0.5–1 mm, shorter than or equal to length of the flowers. Flowers green, 3.5–4 mm diam., the tepals 1 mm, spreading to reflexed, pubescent on both surfaces, deciduous in old flowers, stamens 9, all 4-locular, the outer six 0.7 mm, anther curved inward, filament 0.2 mm, glabrous or with a few hairs, the inner three 0.8 mm, the filament 0.3 mm, with a few hairs, glands present at base of inner stamens, staminodia present, 0.5 mm, with some hairs near base, otherwise glabrous, pistil glabrous, 1.2 mm, style 0.5 mm, receptacle cup-shaped, pubescent inside. Fruit and cupule unknown; receptacle in old flowers shallow, by which I infer that the cupule will be shallow.

Discussion. *Ocotea latipetiolata* is a distinctive species characterized by its large, glabrous leaves, broad and flat petioles, glabrous outer stamens, thick twigs and relatively large staminodia. It does not appear to have close relatives; it is not close to the *O. aciphylla* group, which has more slender, canaliculate petioles.

Phenology. Flowering collections of the new species were made in November and December.

Distribution. *Ocotea latipetiolata* has been collected in Peru from altitudes of 2200–2400 m.

IUCN Red List category. Because this species is only known from two recent collections in a poorly collected part of Peru, *Ocotea latipetiolata* is given the assessment of Data Deficient (DD), based on IUCN (2001) criteria.

Paratype. PERU. **Cajamarca:** San Ignacio, San Jose de Lourdes, Picorana, 04°58′00″S, 78°53′01″W, 3 Dec. 1998, 2350–2450 m, *J. Campos, L. Zurita & M. Camizan 5923* (MO).

17. Ocotea limiticola van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: El Pangui, Cordillera del Condor, 2 km S del destac. militar Condor Mirador, 03°37′28″S, 78°23′35″W, 2010 m, 16 Dec. 2000, *J. Caranqui, G. Pabon & Grupo de Post-Grado MO-QCNE 239* (holotype, MO-6446530; isotypes, B, QCNE not seen). Figure 11.

Ocotea heterochromae Mez & Sodiro similis, sed ab ea floribus minoribus et petiolis planis recedit.

Shrub or small tree, to 4 m; twigs terete or slightly angular, 2–4 mm, densely brown pubescent, hairs very short, ascending to erect and covering surface completely, glabrescent with age; terminal buds densely brown pubescent. Leaves 5–12 × 2.5–7.5 cm, alternate, coriaceous, broadly elliptic, base obtuse to rarely acute, margin plane or somewhat incurved near base, apex obtuse or rarely slightly acute, mature leaves glabrous, immature leaves with some appressed hairs above, mature leaves glabrous or with some appressed hairs along the major veins below, midrib and secondary veins of mature leaves impressed on upper surface and leaves appearing slightly bullate, tertiary venation immersed and not visible on upper surface, midrib and secondary veins clearly raised and tertiary venation slightly raised on lower surface; domatia lacking; secondary veins 4 to 6 on each side; petioles 3–6 mm, flat above, with a similar indument as the twigs. Inflorescences in axils of bracts, infrequently in axils of leaves, 2–7 cm, densely brown pubescent, paniculate cymose, primary branchlets flattened, with only a few cymes; pedicels to 1 mm, lateral flowers of a cyme with petioles as short as 0.3 mm, all pedicels shorter than flowers. Flowers 4–4.5 mm diam., green to whitish green, hypanthium and outer surface of tepals densely pubescent, tepals six, 1–1.3 mm, spreading, inner surface moderately pubescent, with some papillae toward the margin, stamens 9, all 4-locular, outer 6 stamens ca. 0.5 mm, glabrous, about as wide as long, inner 3 stamens 0.7 mm, glabrous, filament 0.3 mm, anther longer than wide, glands present at base of the inner stamens, staminodia sometimes present, stipitiform or with a wide apex and 2 reduced locelli, pistil ca. 1 mm, ovary gradually narrowed into style, receptacle deeply cup-shaped, glabrous inside. Fruits and cupules unknown.

Discussion. *Ocotea limiticola* is a shrub or small tree, best recognized by the combination of dense, short pubescence on twigs and inflorescences, hermaphroditic flowers with a glabrous receptacle, impressed major veins, and an obtuse leaf base. It is only known from a few collections made on a ridge near the border between Ecuador and Peru in scrub or low forest growing on nutrient-poor, sandstone-derived soils. Its closest relatives should be sought among a few other species with small flowers and stamens, flattened inflorescence branchlets, and papillae near the margin of the tepals. These characters are also found in the *O. insularis* group, but species of this group have a dense patch of hairs on the back of the filaments of the inner stamens; such a patch of hairs is lacking in *O. limiticola*.

Distribution. *Ocotea limiticola* has been collected at elevations from 1800 to 2000 m in Ecuador.



Figure 12. Holotype of *Ocotea longipetiolata* van der Werff (*W. Quizhpe & A. Wisum 2645*, MO).

IUCN Red List category. Although this species is only known from one mountain ridge on the border between Ecuador and Peru, it is currently assessed as Not Threatened (NT), according to IUCN (2001) criteria. Land mines are known to have been laid in the area where *O. limiticola* occurs during the armed conflict between Ecuador and Peru in 1995. The presence of land mines is an effective deterrent of exploration (van der Werff, pers. obs.).

Phenology. Flowering specimens have been collected in September and December.

Etymology. The specific epithet refers to its known distribution, the border area between Ecuador and Peru.

Paratypes. ECUADOR. **Zamora-Chinchipe:** El Pangui, a 1 km N del destac. militar Condor Mirador, 03°37′41″S, 78°23′42″W, 1975 m, 6 Sep. 2003, *E. Rodriguez, D. Neill, W. Quizhpe, J. Homeier & C. Padilla 2638* (MO); ca. al destac. militar Condor Mirador, 03°38′08″S, 78°23′22″W, 1800 m, 15–16 Dec. 2000, *E. Freire & Grupo Post-grado 4348* and *4372* (MO), 2000 m, 15 Dec. 2000, *D. Neill & QCNE botany interns 13025* (MO).

18. Ocotea longipetiolata van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Palanda, carretera entre Palanda y Valladolid, 04°36′47″S, 79°07′20″W, 1300 m, 11 Mar. 2007, *W. Quizhpe & A. Wisum 2645* (holotype, MO-6446531; isotypes, B, K, LOJA not seen, NY, P, QCNE not seen, US). Figure 12.

Ocoteae smithii van der Werff similis, sed ab ea floribus sparse pubescentibus et tepalis erectis recedit; ab *Ocotea obovata* inflorescentiis ad apices ramorum aggregatis et floribus sessilibus differt.

Tree, 14 m; twigs terete or slightly angled, ca. 6 mm diam., glabrous or nearly so; terminal buds slender, appressed pubescent. Leaves 15–24 × 7–12 cm, alternate, firmly chartaceous, obovate, base angustate and decurrent on petiole, margin near base revolute, apex obtuse to rounded, glabrous on both surfaces, venation immersed or secondary veins slightly raised on upper surface, midrib and secondary veins raised, tertiary venation immersed and reticulate on lower surface, domatia absent, secondary veins 5 to 7 on each side, petioles 1.5–3 cm, flat above, glabrous. Inflorescences 5–12 cm, moderately to sparsely pubescent, indument denser toward flowers, grouped at tips of branches in axils of bracts, rarely in the axils of leaves, paniculate cymose, flowers sessile or nearly so. Flowers 3 mm diam., yellow, hypanthium very short, tepals sparsely or moderately appressed pubescent, 1.2–1.5 mm, half-erect, inner surface of tepals very sparsely pubescent, stamens 9, all 4-locular, outer 6 stamens 1 mm, filaments with a few hairs, 0.2 mm, anther broad, inner stamens 1.1 mm, filaments with a row of hairs, 0.4 mm, glands present at base of the inner stamens, staminodia 0.4–0.7 mm, stipitiform, with a few hairs near the base, pistil 1.4 mm, glabrous, style 0.4 mm, receptacle shallow, glabrous inside. Fruits and cupules not known.

Discussion. *Ocotea longipetiolata* can be recognized by the combination of hermaphroditic, subsessile flowers, the glabrous inner surface of the receptacle, the long, decurrent petioles, the inflorescences grouped at the tips of the branches, and the obovate leaves with a rounded apex. The long, slender terminal buds and the decurrent leaf bases suggest a relationship with *O. obovata*, but that species differs in its clearly pedicellate flowers, inflorescences in the axils of leaves, and slightly raised tertiary venation on the lower leaf surfaces.

The staminodia are, for the genus, long; one staminode measured 0.7 mm. The three collections of *Ocotea longipetiolata* are similar in flower size and shape and are inferred to be hermaphroditic. Were this species to have unisexual flowers, it is likely that both dissimilar flower types would be represented among the three collections.

Distribution. In addition to the type collection from southern Ecuador, *Ocotea longipetiolata* is also known from two collections in Central Peru. These two collections are from the Bosque de Protección San Matias-San Carlos, a poorly explored region just east of the Cordillera de Yanachaga in the department of Pasco. The altitudinal distribution is from 550 to 1300 m.

Phenology. Flowering collections were made in March and April.

IUCN Red List category. Because *Ocotea longipetiolata* is only known from three collections, it is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

Paratypes. PERU. **Pasco:** Oxapampa, Distr. Villa Rica, Bosque Protecc. San Matias-San Carlos, Chatarra-Alto Cacazú, 10°43′54″S, 75°11′53″W, 550–850 m, 24 Apr. 2007, *R. Vásquez & E. Becerra 32410* (MO); Distr. Villa Rica, Puellas-Yuncullmas, 10°34′22″S, 75°05′37″W, 677 m, 24 Apr. 2009, *L. Valenzuela, A. Peña & J. L. Mateo 12608* (MO).

19. Ocotea macrophylla Kunth, Nov. Gen. Sp. 2: 131, 1818. TYPE: Colombia, *Humboldt & Bonpland s.n.* (holotype, B not seen; isotype, P).

Oreodaphne helicterifolia Meisn., DC. Prodr. 15: 123. 1864, syn. nov. *Ocotea helicterifolia* (Meisn.) Hemsl., Biol. Centr. Amer. Bot. 3: 73. 1882. *Phoebe helicterifolia* (Meisn.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 193. 1889. TYPE: Mexico. Chiapas, *J. J. Linden 1641* (isotypes, G-272146/1, G-272146/2, [barcodes] G00369355, G00369356, K [barcode] 00602143, NY-259796 [G-DC fragm.]).



Figure 13. Holotype of *Ocotea mollivillosa* van der Werff (*I. Huamantupa & G. Calatayud 2353*, MO).

Trees, to 20 m; twigs terete, solid, 2–3 mm diam., densely brown hirsute, hairs erect, usually straight but surface partially visible; terminal buds densely tomentose. Leaves 8–30 × 5–11 cm, alternate, chartaceous, narrowly to broadly elliptic or obovate, frequently broadest above the middle, pinnately veined, base acute, obtuse, rounded to cordate, margin plane, apex obtuse, acute, or acuminate, midrib and lateral immersed or slightly impressed, tertiary venation immersed on upper surface, midrib

and lateral veins raised, tertiary venation slightly raised on lower surface; upper surface sparsely to moderately pubescent, hairs erect and discernable to the touch, or glabrous, lower surface moderately to sparsely pubescent, hairs erect and discernable to the touch, most of the surface visible between hairs, indument denser along major veins; domatia absent; lateral veins 5 to 13; petioles 4–15 mm, flat above, with a similar indument as the twigs. Inflorescences 6–30 cm, (sparsely) hirsute, hairs erect, surface well visible, paniculate cymose, in axils of leaves or cataphylls. Flowers 5–8 mm diam., white or yellowish, perfect. Tepals 2–3 mm, elliptic, glabrous on both surfaces or the inner surface somewhat papillose, spreading at anthesis; outer 6 stamens 1–1.5 mm, sessile or nearly so, glabrous, cells introrse and arranged on 2 pairs, a sterile tip lacking, inner 3 stamens 1–1.5 mm, filaments 0.2 mm, glabrous or with a few hairs, cells lateral-extrorse, arranged in 2 pairs, glands present at base of filaments, staminodia 3, small, 0.3 mm, hidden between glands; pistil ca. 2 mm, glabrous, style 0.6 mm, receptacle cup-shaped, glabrous inside. Fruits ellipsoid, 2.5 × 1.5 cm, cupule at maturity very shallow, almost platelike, 1 cm diam., with a single margin, tepals deciduous in fruit; immature cupules cup-shaped; pedicels swollen in fruit.

Discussion. Characteristics for *Ocotea macrophylla* are the erect indument on twigs and leaves, the relatively large, glabrous flowers with spreading tepals, and the swollen pedicel in fruit with a small, shallow cupule. It is very similar to *O. valerioana* (Standl.) W. C. Burger, which is distinguished by its denser, short, matted indument on the twigs that covers the surface entirely, whereas the surface of the twigs of *O. macrophylla* is partially visible through the pubescence (van der Werff, 1999).

The type of *Ocotea macrophylla* is a fruiting specimen. Recent flowering collections from Venezuela and Colombia that match the type in indument and leaf shape are conspecific with *O. helicterifolia* (Meisn.) Hemsl., a rather common species from Central America. Therefore, *O. helicterifolia* is here considered a synonym of *O. macrophylla*. For additional synonymy of *O. macrophylla*, see van der Werff (2002) under *O. helicterifolia*.

Distribution. *Ocotea macrophylla* occurs from southern Mexico to Colombia and Venezuela. In South America, it has been collected from altitudes of 500–1300 m.

Selected specimens examined. COLOMBIA. **Antioquia:** Venecia, *Sanchez & Eussse 1371* (MO). **Quindio:** Mun. La Tabaida, *Vargas 1360* (MO). **Valle:** Mun. Dagua, *Vargas 4977* (MO). VENEZUELA. **Mérida:** La Azulita, *Breteler 4928* (MO), *Ruiz Teran 1558* (MO).

20. Ocotea mollivillosa van der Werff, sp. nov. TYPE: Peru. Cusco: Urubamba, Distr. Machu Picchu, Aguas Calientes, Trocha Hiran Bingham, 13°10′33″S, 72°31′11″W, 2250 m, 5 Sep., *I. Huamantupa & G. Calatayud 2353* (holotype, MO-6446521; isotypes, AMAZ not seen, CUZ not seen, HUT not seen, MOL not seen, US, USM not seen). Figure 13.

A congeneris floribus hermaphroditis foliis angustis vel ellipticis trichomatibus albidis erectis praeditis recedit.

Shrub or small tree, to 8 m; twigs terete, 3 mm diam., densely pubescent with erect, white hairs, surface nearly completely covered; terminal buds densely white pubescent. Leaves 4–7 × 1–4 cm, alternate, lanceolate to elliptic, chartaceous, base acute or obtuse, apex acute, margin flat, initially moderately pubescent with soft, white hairs on upper surface, densely pubescent on major veins, indument wearing off with age, moderately to sparsely pubescent with soft, white hairs on lower surface, major veins densely pubescent, midrib raised, secondary and tertiary venation slightly raised on upper surface, secondary veins 4 to 7 on each side, inconspicuous, reticulation raised on lower surface, domatia absent, petioles 3–5 mm, densely white pubescent, flat above. Inflorescences 2–6 cm, in the axils of leaves or bracts, consisting of a peduncle with up to 6 lateral cymes, these toward the tip of inflorescences, densely white pubescent; pedicels to 4 mm long. Flowers creamy yellow, 4.5 mm diam., moderately pubescent with short, erect hairs, tepals spreading, 1.5 mm, inner surface pubescent, stamens 9, all 4-locular, outer stamens 1.2 mm, slender filament with a few hairs, as long as the anther, glands present at base of inner stamens, inner stamens 0.8 mm, the locelli lateral, filament slightly shorter than anther, staminodia stipitiform, with a few hairs, pistil 1.5 mm, glabrous, style as long as ovary, stigma a small disk, receptacle cup-shaped, glabrous inside. Immature cupules funnel-shaped, 4 mm high, 7 mm diam., the tepals initially persisting, but wearing off with age; immature fruit ca. 4 × 5 mm.

Discussion. *Ocotea mollivillosa* is a very distinctive species characterized by its small, lanceolate to elliptic leaves with erect, soft, white hairs and few-flowered inflorescences. I have not seen other species like it among the Andean species. Its indument is reminiscent of *O. mollicella* (S. F. Blake) van der Werff, a species known from few collections from

Costa Rica. An erect, rather dense pubescence is also found in the species of the *O. helicterifolia* group, but these species usually have a papillose indument at the tips of the tepals or on the stamens. A papillose indument is lacking in *O. mollivillosa*; also, flowers in the *O. helicterifolia* group are usually larger (tepals 2–3.5 mm long vs. 1.5 mm in *O. mollivillosa*). The two species of the *O. helicterifolia* group known from the Andean countries (*O. macrophylla* and *O. valerioana* have larger leaves (8–40 cm) and are restricted to Colombia, Venezuela, and northern Ecuador.

Habitat and distribution. *Ocotea mollivillosa* is known from altitudes of 2250–2800 m in Peru. Two paratypes were collected in secondary forest, whereas the type collection was noted from bosque seco. One paratype was, according to the label, collected at a lower altitude than the other paratypes, even though the localities were close. In addition the habitat (bosque nublado de ceja de selva) suggests a higher altitude, and it is likely that the altitude for *Núñez 8639* is an error.

IUCN Red List category. *Ocotea mollivillosa* is only known from three collections and is assessed as Data Deficient (DD) based on IUCN (2001) criteria.

Phenology. *Ocotea mollivillosa* has been collected with flowers in September (the type) and with immature fruits in November and January (the paratypes).

Paratypes. PERU. **Cusco:** Urubamba, Distr. Machu Picchu, Pampacahua, 13°06′S, 72°16′W, 2580–2800 m, 23 Jan. 2005, *L. Valenzuela et al. 4718* (MO); Pampacahua, 13°06′S, 72°13′W, 2300 m, 27 Jan. 2005, *L. Valenzuela et al. 4880* (MO); Urubamba, aprox 112 km de Cusco en el camino de herradura de las ruinas de Machupicchu, 13°09′S, 72°31′W, 1050–1300 m, 18 Nov. 1987, *P. Núñez 8639* (MO).

21. Ocotea monzonensis Mez, Repert. Spec. Nov. Regni Veg. 3: 71, 1906. TYPE: Peru. Huánuco: Huamalies, Berge sudostlich von Monzon, 2000–2300 m, 20 Oct. 1903, *A. Weberbauer 3712* (holotype, B; isotypes, B [barcode] 100247530, MO-1671279 [B photo]).

Shrub, 3 m; twigs 3 mm diam., terete, densely pubescent, hairs appressed or ascending; terminal buds not visible on the holotype, but likely densely pubescent. Leaves 4–7 × 2.2–3.5 cm, alternate, chartaceous, elliptic, base and apex acute, margin flat, upper surface glabrous, lower surface sparsely pubescent, hairs appressed or ascending, venation immersed on upper surface, midrib raised, secondary slightly less raised, tertiary venation slightly raised, reticulate, domatia present as axillary tufts of hairs, sometimes small domatia present along secondary veins; secondary veins 4 to 6 on each side; petioles 5–7 mm, flat above, with similar indument as the twigs. Inflorescences 1.5–6 cm, mostly in axils of bracts, occasionally in axils of leaves, few-flowered, with up to 4 cymes, 12 flowers, moderately to sparsely pubescent with mostly appressed hairs; pedicels 3–6 mm, sparsely pubescent. Flowers 2–3 mm diam., greenish yellow, sparsely pubescent; tepals six, 1.2 mm, inner surface moderately pubescent, stamens 9, all 4-locular, outer 6 stamens 0.6 mm, filament with a few hairs, half as long as the anther, inner 3 stamens 0.8 mm, locelli lateral, large, filament about as long as anther; glands present at base of inner stamens, staminodia 0.3 mm, stipitate, tip slightly swollen, pubescent; pistil 0.4 mm, glabrous, ovary gradually narrowed in style, stigma disklike, receptacle cup-shaped, glabrous inside.

Discussion. *Ocotea monzonensis* is best recognized by the domatia on its leaves that consist of tufts of hairs in the axils of the secondary veins as well as smaller domatia along the secondary veins, by the few-flowered inflorescences, and by the leaves with distinct petioles. Domatia consisting of axillary tufts of hairs also occur among the Andean *Ocotea* species in the *O. insularis* group; species of this group, however, differ in their many-flowered inflorescences (up to 150 flowers), flattened inflorescence branches, and stamens of whorl III with a patch of hairs at the junction of the filament and the anther. The *O. insularis* group is best represented in Central America; in South America it occurs in Colombia and Ecuador, but has not yet been recorded from Peru. *Ocotea monzonensis* is only known from the type collection in Peru.

22. Ocotea munacensis O. C. Schmidt, Repert. Spec. Nov. Regni Veg. 31: 185. 1933. TYPE: Peru. Huánuco: Prov. Huánuco, "zwischen Chagalla und Muna," 2500–2600 m, 23 July 1913, *A. Weberbauer 6794* (holotype, B, GH image, MO-5198713 [GH photo]).

Shrub, 4 m; twigs 3 mm diam., moderately to sparsely pubescent with short, erect hairs, becoming glabrous with age; terminal buds densely pubescent with ascending to erect hairs. Leaves alternate, elliptic, 5–9 × 3–4 cm, firmly chartaceous, base acute to obtuse, margin flat, apex bluntly acute, upper surface glabrous, lower surface glabrous or nearly so, domatia present as tufts of hairs in axils of secondary veins, venation immersed on upper

surface, raised on lower surface, including tertiary reticulate venation, secondary veins 5 to 7 on each side, petioles 3–5 mm, terete, with a similar indument as the twigs. Inflorescences 2–2.5 cm, in axils of leaves, sparsely pubescent with short, erect hairs, racemose, flowers clustered at end of inflorescences. Flowers greenish white, funnel-shaped, subtended by linear or narrowly elliptic bracts, these to 2 mm, pubescent; pedicels ca. 2 mm, glabrous, tepals spreading, 2 mm, glabrous or with a few hairs outside, inner surface moderately papillose and with some longer hairs near base; stamens 9, glabrous, all 4-locular, outer 6 stamens 1.5 mm, filaments 0.5 mm, inner stamens 1.3 mm, with 2 glands at base; staminodia present, 0.5 mm, with a few hairs, receptacle glabrous inside, cup-shaped. Fruit and cupules not known.

Discussion. *Ocotea munacensis* resembles *O. monzonensis*, sharing the presence of domatia, few-flowered inflorescences, and leaves with similar shape, size, and venation. Previously Rohwer (1986) suggested the two species might not be really different. The type specimens of both species come from the Department of Huánuco, at similar altitudes. Differences separating the species are as follows: *O. monzonensis* has densely pubescent twigs, loosely branched inflorescences, pedicels 3–6 mm, tepals 1.2 mm, and vein reticulation immersed on the lower leaf surface; while *O. munacensis* has sparsely pubescent twigs, compact inflorescences, pedicels to 2 mm, tepals 2 mm, and a raised reticulation on lower leaf surfaces. A recent collection from Cusco (*Nuñez 8374*, MO) is related to the two species: it has a dense indument on the twigs, lax inflorescences, and the longer pedicel lengths found in *O. monzonensis* yet with the length of tepals and raised vein reticulation of *O. munacensis*. It differs from both in narrower leaves (10 × 3 cm) and in having short, erect hairs on the lower leaf surface. Additional collections are needed to determine if these specimens should be placed in one species or if three species are involved. At this moment *O. munacensis* is only known from the type collection.

23. Ocotea pacifica van der Werff, Novon 19: 538. 2009. TYPE: Ecuador, Pichincha, *H. van der Werff, B. Gray & G. A. Tipaz 12269* (holotype, QCNE; isotype, MO-3873367).

Trees, to 45 m; twigs 3 mm diam., densely brown tomentulose, surface completely covered when young, indument sparser with age; terminal buds densely brown tomentulose. Leaves alternate, elliptic to obovate, 9–21 × 3–8 cm, chartaceous, gradually narrowed toward base, but not decurrent on petiole, flat or faintly inrolled near base, tip shortly acuminate, upper surface glabrous except for some pubescence on midrib, lower surface sparsely to moderately pubescent, hairs erect or ascending, domatia lacking, venation immersed on upper surface, raised on lower surface, tertiary venation scalariform, secondary veins 9 to 12 on each side; petioles 5–10 mm, flat above. Inflorescences 9–23 cm, paniculate cymose, in axils of distal leaves, densely tomentulose, surface not visible. Flowers yellowish, funnel-shaped, base gradually narrowed in pedicels, pedicels ca. 2 mm, tepals ca. 1.5 mm, half-erect, densely pubescent on outer surface, sparsely pubescent on inner surface, stamens 9, all 4-locular, 0.8–1 mm, outer 6 with locelli opening introrse, inner 3 with locelli opening extrorse, filaments pubescent, ca. 1/3 as long as the anther, anthers glabrous, staminodia representing whorl IV present, stipitiform, ca. 0.5 mm, pubescent; pistil ca. 2 mm, glabrous, style 0.5 mm, receptacle deep, pubescent inside. Fruit 3.5 × 1.8 cm, ellipsoid, cupule near maturity shallowly cup-shaped, 15 × 8 mm, immature cupules more deeply cup-shaped.

Discussion. *Ocotea pacifica* can be recognized by its gradually narrowed leaf bases, erect or ascending hairs on the lower leaf surface and the scalariform tertiary venation of the leaf blades. It has been confused with *O. stenoneura* Mez & Pittier, a species from Costa Rica and Panama, which differs in a denser pubescence on the inner surface of the tepals, tepal surface not visible (vs. sparsely pubescent, with tepal surface partly visible), decurrent and inrolled leaf bases (vs. not decurrent and not or scarcely inrolled), a round or nearly so fruit seated on a platelike cupule (vs. an ellipsoid fruit seated in a shallow cupule). Collections of *O. pacifica* from the lowlands of Esmeraldas (Ecuador) have a sparser, almost appressed indument on the leaves.

Distribution. *Ocotea pacifica* has been collected from sites at altitudes from 50 to 1400 m.

Phenology. *Ocotea pacifica* has been collected in flower from March to July and in fruit from July and October.

Selected specimens examined. COLOMBIA. **Antioquia:** Yali, *Fernandez & Jimenez 45* (MO); Boyaca, El Humbo, *Lawrance 728* (MO). ECUADOR. **Esmeraldas:** Quininde, Bilsa Biol. Station, *Clark & Watt 925* (MO). **Los Rios:** Hac. Clementina, *Ståhl & Cornejo 6048* (MO). **Pichincha:** along rd. Nanegal–Palmitopamba, *van der Werff et al. 12284* (MO).



Figure 14. Holotype of *Ocotea pedanomischa* van der Werff (*H. van der Werff, R. Vásquez & C. Rojas 22886*, MO).

24. Ocotea pedanomischa van der Werff, sp. nov. TYPE: Peru. Pasco: Oxapampa, La Suiza Vieja, 10°40′17″S, 75°30′45″W, 2300 m, 28 Oct. 2009, *H. van der Werff, R. Vásquez & C. Rojas 22886* (holotype, MO-6446520; isotypes, B, F, HOXA, US, USM). Figure 14.

A ceteris speciebus gregis *Ocoteae aciphyllae* (Nees & Mart.) Mez petiolis brevibus (usque 6 mm longis) recedit.

Shrubs or small trees, 1–15 m; twigs 2–3 mm diam., angular, moderately appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 4–8 × 1.7–4.5 cm, elliptic to broadly elliptic, alternate, coriaceous, base acute to rounded, margin flat or slightly revolute near base, apex varying from shortly acuminate to obtuse, upper surface glabrous, lower surface glabrous or sparsely appressed pubescent, midrib and secondary veins immersed or impressed, tertiary venation immersed and finely reticulate on upper surface, midrib raised, secondary veins raised or immersed, tertiary venation immersed on lower surface, secondary veins 5 to 8 on each side, domatia lacking, petioles 3–6 mm, weakly canaliculate or flat, with same indument as twigs. Inflorescences 4–10 cm, paniculate cymose, in axils of leaves or bracts, moderately to sparsely appressed pubescent; pedicels 0.5–1 mm, sparsely appressed pubescent. Flowers green or yellow, 2.5–3 mm diam., sparsely pubescent, tepals half-erect to spreading in old flowers, 1–1.4 mm, sparsely pubescent or subglabrous, inner surface with a few hairs, stamens 9, all 4-locular, outer six 0.8–1.1 mm, glabrous or filaments with a few hairs, filaments 0.3 mm, inner 3 stamens 1 mm, filament 0.3 mm, with a few hairs, glands present at base of inner stamens, staminodia 0.3 mm, stipitiform, pubescent, pistil glabrous, 1.4 mm, style 0.5 mm, receptacle deep, pubescent inside. Fruits broadly ellipsoid, 3 × 2.2 cm, cupules bowl-shaped to shallowly bowl-shaped, to 1.8 cm diam., 7 mm high, tepals deciduous in fruiting stage.

Discussion. *Ocotea pedanomischa* can be recognized by its short petioles, small flowers with short pedicels, and small leaves. It resembles *O. choquetangensis*, but the latter species has larger flowers, with the tepals 2 mm long (vs. 1–1.4 mm in *O. pedanomischa*), and deeply cup-shaped (vs. bowl-shaped to shallowly bowl-shaped) cupules. The taxonomic concept of *O. pedanomischa* as accepted here is fairly broad. The Peruvian collections from Pasco have generally rounded to obtuse leaf bases and broad cupules, while collections from southern Ecuador tend to have acute leaf bases and narrower (to 1.2 cm wide), more cup-shaped cupules. However, some collections from Ecuador (for instance, *Neill et al. 13718* and *van der Werff et al. 21857*) are very similar to more narrow-leaved specimens from Pasco (for instance, *van der Werff et al. 22867*). Although the more narrow-leaved specimens from Ecuador such as *Homeier 1247* seem different from most collections from Pasco, I am reluctant to recognize the Ecuadorian specimens as distinct from the Pasco specimens based solely on vegetative differences, and these are herein accepted as paratypes within the variability of the species.

The Pasco specimens have been collected mostly on nutrient-poor, sandstone-derived soils in low forest or shrub vegetation. The low trees have as a rule immersed secondary veins, while the shrubs have the secondary veins impressed, thus giving the leaves a bullate appearance.

Habitat and distribution. The new species has been collected at altitudes from 2000 to 3100 m in Peru and Ecuador.

IUCN Red List category. *Ocotea pedanomischa* has a wide distribution and is relatively common in the National Park Yanachaga-Chemillen and is therefore assessed as Least Concern (LC).

Phenology. Flowers have been collected in August, October, and February, but mostly in October.

Etymology. The specific epithet is derived from the Greek *pedanos* (short) and *mischos* (stalk), referring to the 3–6 mm petioles of the leaves.

Paratypes. ECUADOR. **Zamora-Chinchipe:** Nangaritza, Cordillera de Nanquipa, Cerro Colorado, 04°07′29″S, 78°46′25″W, 2740 m, 17 Feb. 2002, *D. Neill, W. Quizhpe, J. M. Manzanares, A. Hirtz, T. Delinks & C. J. Cole 13718* (MO); Est. Cient. San Francisco, 03°58′S, 79°04′W, 2340 m, *J. Homeier 326, 514, 984, 1217, 1247, 4259* (all MO); along new rd. Loja–Zamora, 2500 m, 25 Apr. 1987, *H. van der Werff & W. Palacios 8996* (MO), *9001* (MO); Palanda, Reserva Tapichalaca, 04°29′4″S, 79°07′55″W, 2500–2700 m, 31 Oct. 2006, *H. van der Werff, B. Gray & W. Quizhpe 21806, 21857* (MO). PERU. **Amazonas:** Mendoza, Huamanpata, 06°19′S, 77°31′W, 2000 m, 7 May 2005, *T. Pennington, A. Daza & J. Léon 17865* (MO); Distr. Chachapoyas, ca. Molinopampa, 06°12′45″S, 77°40′59″W, 2100–2500 m, 10 Apr. 2001, *H. van der Werff, B. Gray & W. Quizhpe 16902* (MO). **Cajamarca:** San Ignacio, Santuario Nac. Tabaconas-Namballe, 05°15′00″S, 79°19′00″W, 2300–2400 m, 14 Nov. 1998, *J. Campos, O. Garcia, M. Tenorio & L. Adrianzen 5694* (MO); San Ignacio, Huarango, Cordillera entre Romerillo y Nuevo Mundo, 05°16′12″S, 78°40′01″W, 2200 m, 13 Mar. 2000, *J. Campos et al. 6596* (MO). **Pasco:** Oxapampa, Distr. Huancabamba, Parque Nac. Yanachaga-Chemillen, 10°22′42″S, 75°27′00″W, 2650 m, 30 Nov. 2007, *A. Monteagudo, A. Peña, V. Flores & R. Rivera 16048* (AMAZ not seen, HUT not seen, MO, USM not seen); Distr. Huancabamba, Parque Nac. Yanachaga-Chemillen, la Colmena, 10°26′32″S, 75°26′17″W, 2429 m, 25 Aug. 2008, *L. Valenzuela, J. L. Mateo & R. Rivera 11752* (HOXA not seen, HUT not seen, MO, MOL not seen, USM not seen); Distr. Huancabamba, 10°22′42″S, 75°27′00″W, 2650 m, 1 Dec. 2007, *A. Monteagudo, A. Peña, V. Flores & R. Rivera 16068* (HOXA not seen, MO, USM not seen); Distr. Huancabamba, sector Milpo, parte alto camino a Santa Barbara, 10°13′S, 75°22′W, 3000 m, 1 Feb. 2005, *A. Monteagudo & R. Francis 8094* (MO);



Figure 15. Holotype of *Ocotea pichinchensis* van der Werff (*H. van der Werff, B. Gray & P. Fuentes 13401*, MO).

Oxapampa, Milpo, 10°23′01″S, 75°37′46″W, 2950–3100 m, 31 Oct. 2009, *H. van der Werff, R. Vásquez, A. Peña, L. Mateo & R. Rivera 22928* (MO); Distr. Villa Rica, Reserva Mun. Bosque de Sholl'et, 10°24′S, 75°11′W, 2441 m, 6 July 2005, *R. Rojas 3621* (AMAZ not seen, HUT not seen, MO, MOL not seen, USM not seen); Distr. Oxapampa, Parque Nac. Yanachaga-Chemillen, sector San Alberto en el Abra Esperanza y alrededores, 10°31′55″S, 75°20′59″W, 2780 m, 2 Oct. 2007, *L. Hernani & A. Peña 360* (MO); Distr. Oxapampa, Parque Nac. Yanachaga-Chemillen, Abra Esperanza, 10°31′42″S, 75°21′15″W, 2909 m, 15–16 Apr. 2009, *M. Cueva 521* (MO), *556* (MO);

Oxapampa, Cordillera Yanachaga, Chacos, 20°35′S, 75°20′W, 2700–2800 m, 7 Oct. 1982, *R. Foster 9030* (MO); Distr. Oxapampa, sector Chacos, 10°09′04″S, 75°17′37″W, 2818 m, 13 Feb. 2004, *R. Rojas, J. Lingan, K. Meza & J. Macedo 2093* (MO, USM not seen); Distr. Oxapampa, Sector Chacos, 10°37′S, 75°17′W, 2750 m, 12 Jan. 2004, *R. Vásquez, J. Perea, A. Peña, R. Francis & L. Mateo 28624* (MO, USM not seen), 4 Mar. 2005, *R. Vásquez, A. Monteagudo & L. Mateo 30767* (MO, USM not seen), 14 Aug. 2007, *R. Vásquez, G. Castillo, V. Flores, L. Hernani & D. Vásquez 32726* (AMAZ not seen, HUT not seen, MO, USM not seen), 1 July 2008, *R. Vásquez, R. Ortiz, J. Pruski, G. Castillo & R. Rivera 34473* (HOXA not seen, HUT not seen, MO, MOL not seen, USM not seen); Oxapampa, La Suiza Vieja, 10°40′17″S, 75°30′45″W, 2300 m, 28 Oct. 2009, *H. van der Werff, R. Vásquez & C. Rojas T. 22849* (MO), *22867* (MO), *22884* (MO); Oxapampa, La Suiza Vieja, 10°28′14″S, 75°27′44″W, 2170 m, 20 Oct. 2009, *H. van der Werff, R. Vásquez & E. Macaca 22688* (MO), *22692* (MO); Oxapampa, La Suiza Vieja, 10°40′17″S, 75°30′45″W, 2300 m, 9 Nov. 2009, *H. van der Werff, R. Vásquez A. Peña & C. Rojas T. 23432* (MO), *23437* (MO).

25. Ocotea pichinchensis van der Werff, sp. nov. TYPE: Ecuador. Pichincha: along new rd. Nanegal–Mindo, 1600–1800 m, 3 Mar. 1994 (fl.), *H. van der Werff, B. Gray & P. Fuentes 13401* (holotype, MO-6461897; isotypes, B, CNS, F, K, NY, QCNE, US). Figure 15.

Ocoteae aciphyllae (Nees & Mart.) Mez similis, sed ab ea ramulis crassioribus, foliis majoribus acutis (nec acuminatis) et tepalis semierectis (nec patentibus) recedit.

Trees, to 30 m; twigs angular, 5–9 mm diam., moderately appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 12–23 × 5–10 cm, coriaceous, alternate, elliptic, base varying from acute to rounded, margin revolute near base and sometimes shortly decurrent on petiole, apex acute, but most apices damaged, upper leaf surface glabrous, lower surface sparsely appressed pubescent to glabrous, venation on upper surface immersed, surface smooth, midrib raised, secondary venation slightly raised and tertiary venation immersed on lower surface, secondary veins 7 to 9 on each side, domatia lacking, petioles 16–26 mm, canaliculate, with a similar indument as the twigs. Inflorescences in the axils of bracts or leaves or along leafless short shoots, 4–7 cm, densely pubescent, hairs appressed or ascending, paniculate cymose, pedicels 1–2 mm. Flowers 4 mm diam., hypanthium and tepals outside densely pubescent, tepals half-erect, 1.6–1.8 mm, the inner surface pubescent; stamens 9, all 4-locular, outer six 1 mm, filament 0.3 mm, filament and anther dorsally pubescent, inner 3 stamens 1.1 mm, filament 0.3 mm, filaments dorsally pubescent, glands present at base of inner stamens, staminodia present, 0.4 mm, stipitiform, pubescent, pistil glabrous, 2.5 mm, style 1 mm, receptacle deep, densely pubescent inside. Very immature fruits (3 mm diam.) enclosed in the receptacle, tepals deciduous; mature fruits and cupules not known.

Discussion. *Ocotea pichinchensis* can be recognized by its rather large, coriaceous leaves, dense, yellowish white indument of the flowers and inflorescences, half-erect tepals, and pedicellate flowers. Vegetatively it resembles *O. albida*, a species from Bolivia and central Peru, which differs in its sessile flowers, grayish white indument, smaller leaves, and thinner twigs. *Ocotea aciphylla* differs in having rotate flowers (vs. tepals half-erect), smaller, acuminate leaves and thinner twigs.

Habit and distribution. *Ocotea pichinchensis* is known from only three collections, one from the Reserva Biologica Maquipucuna and the other two from forest remnants along the Nanegal–Mindo road, all in the Ecuadorian province of Pichincha. It has been collected at altitudes from 1500 to 1800 m.

IUCN Red List category. Because little forest remains in the area of the three collections and it is likely that *Ocotea pichinchensis*, a tall tree, is cut for its timber, it is given an assessment of Endangered (EN), according to IUCN (2001) criteria.

Phenology. The two flowering collections were made in March; immature fruits were collected in May.

Paratypes. ECUADOR. **Pichincha:** Quito Canton, Reserva Biol. Maquipucuna, 00°10′N, 78°40′W, 1500–1700 m, 17–31 May 1991, *C. Quelal & G. Tipaz 2* (MO); along new rd. Nanegal–Mindo, 1500–1800 m, 2 Mar. 1994, *H. van der Werff, B. Gray & P. Fuentes 13386* (MO).

26. Ocotea piurensis Mez, Repert. Spec. Nov. Regni Veg. 16: 308. 1920. TYPE: Peru. Dept. Piura, Prov. Ayavaca, *Weberbauer 6348* (lectotype, here designated, B; syntypes, *Weberbauer 6352*, *6428* B).

Trees, to 25 m; twigs terete, 3–4 mm diam., lenticellate, glabrous; terminal buds minutely appressed pubescent, surrounded by bracts. Leaves 10–17 × 4–9 cm, alternate, firmly chartaceous, elliptic to broadly elliptic, base mostly obtuse, but varying from acute to rounded, margin flat, apex acute or obtuse, glabrous on both surfaces, upper surface shiny, midrib immersed, secondary veins and tertiary venation slightly raised, lower surface with raised midrib, secondary veins and tertiary venation slightly



Figure 16. Holotype of *Ocotea smithii* van der Werff (*D. Smith, V. Garcia, L. Dorr & L. Barnett 13918*, MO).

raised, domatia lacking, secondary veins 6 to 9 on each side, petioles 8–14 mm, glabrous, flat above. Inflorescences 5–12 cm, moderately pubescent with short, erect hairs, in axils of bracts at tips of branches or along leafless short shoots, paniculate, flowers probably arranged in cymes, but peduncles of the cymes shortened and flowers clustered when several cymes are present at tips of inflorescence branchlets; pedicels 1–1.5 mm, densely pubescent. Flowers 3.5 mm diam., yellow-green, tepals spreading, 1 mm,

densely and minutely pubescent on both surfaces, indument becoming papillose toward margin, united at base and falling off in old flowers as a unit, stamens 9, all 4-locular, 0.6 or 0.7 mm, filaments with a few hairs, 0.2 mm, inner stamens with lateral locelli, glands present at base of inner stamens, staminodia not seen, pistil 1.5 mm, glabrous, style about as long as ovary, receptacle deep, glabrous inside. Immature fruit 13 × 8 mm, cupules deeply cup-shaped, 1 cm wide, ca. 1 cm deep, with a simple margin.

Discussion. *Ocotea piurensis* is easily recognized by its clustered flowers due to the reduced peduncles of the cymes, inflorescences that occur in the axils of bracts, and by the lenticellate twigs. Often the inflorescences are grouped along leafless short shoots but are also present in the axils of bracts surrounding the terminal buds. The tepals are fused at their bases and fall from older flowers as a single unit, an unusual character in the genus *Ocotea*. In addition to the type collections, *O. piurensis* is known from four recent collections, all from northwestern Peru. Two of the recent collections were made at 720 m in altitude, one at 940 m and the fourth at 925–1500 m. Three collections from northwest Peru and southwest Ecuador differ in having pedicels 6–8 mm long and petioles to 6 mm long; inflorescences are sparsely pubescent to glabrous. These collections are only provisionally included in *O. piurensis*.

Distribution. Collections of *Ocotea piurensis* in northern Peru range from 700 to possibly 1500 m in altitudinal extent.

Phenology. *Ocotea piurensis* has been collected in flower in July and January and with fruits in October, November, and January.

Selected specimens examined. PERU. **Cajamarca:** entre Olmos y Jaen, *Diaz 2079* (MO). **Lambayeque:** Prov. Lambayeque, Olmos-Jaen, *R. Vásquez et al. 20533* (MO). **Tumbes:** Prov. Zarumilla, Bosque Nac. de Tumbes, *C. Díaz S. 4698* (MO), *4803* (MO).

27. Ocotea smithii van der Werff, sp. nov. TYPE: Bolivia. Dept. La Paz, Sud Yungas, Km. 7 de Huancane en carretera a San Isidro, 67°31′W, 16°21′S, 2300 m, 13 Dec. 1989, *D. Smith, V. Garcia, L. Dorr & L. Barnett 13918* (holotype, MO-6446526; isotypes, B, BOLV not seen, F, G, GH, HBG, K, L, LE, LPB not seen, NY, USZ not seen). Figure 16.

A congeneris floribus hermaphroditis praeditis haec species foliis magnis basi decurrentibus et floribus subsessilibus recedit.

Tree, 25 m; twigs angular, 5–7 mm diam., densely pubescent with short, appressed or ascending hairs; terminal buds densely grey pubescent. Leaves 14–28 × 7–13 cm, alternate, firmly chartaceous, obovate-elliptic to elliptic, base angustate and decurrent on petiole, margin slightly revolute near base, apex bluntly acute, obtuse or rounded, glabrous, venation immersed on upper surface, raised on lower surface, tertiary venation reticulate, domatia lacking, secondary veins 8 to 11 on each side; petioles 10–15 mm, flat above, with a similar indument as twigs. Inflorescences in axils of bracts or leaves, 5–20 cm, paniculate cymose, moderately to densely pubescent, hairs erect or ascending; pedicels to 0.5 mm, densely pubescent. Flowers 4 mm diam., green, hypanthium and outside of tepals densely pubescent, tepals half-erect, 2 mm, the inner surface moderately pubescent, inner stamens 1.5 mm, filament 0.3 mm, with some hairs, anther slightly wider than filament, glands present at base of inner stamens, staminodia present, 0.5 mm, tip slightly swollen, sometimes with rudimentary locules, with a few hairs near base, pistil 1.5 mm, glabrous, style as long as ovary, receptacle cup-shaped, glabrous inside. Fruits and cupules not known.

Discussion. *Ocotea smithii* is a distinctive species best recognized by the combination of hermaphroditic flowers, glabrous inner receptacle surface, sturdy and angular twigs, large and glabrous leaves with a decurrent base, and subsessile flowers. *Ocotea fistulosa* van der Werff, a species known from northern Ecuador, is vegetatively similar, but differs in its thicker, hollow twigs and its revolute leaf base. Although the Yungas area in Bolivia is reasonably well known botanically, this species is only known from the type collection.

IUCN Red List category. Because *Ocotea smithii* is only known from a single collection, it is assessed as Data Deficient (DD), based on IUCN (2001) criteria.

Etymology. This species is dedicated to the late David Smith, whose excellent collections have greatly improved our knowledge of the flora of Peru and Bolivia.

28. Ocotea solomonii van der Werff, sp. nov. TYPE: Bolivia. La Paz: Nor Yungas, 16.2 km NE of Chuspipata on rd. to Yolosa, 2000 m, 21 Oct. 1984, *J. Solomon 12539* (holotype, MO-6480760; isotype, B, LPB not seen). Figure 17.

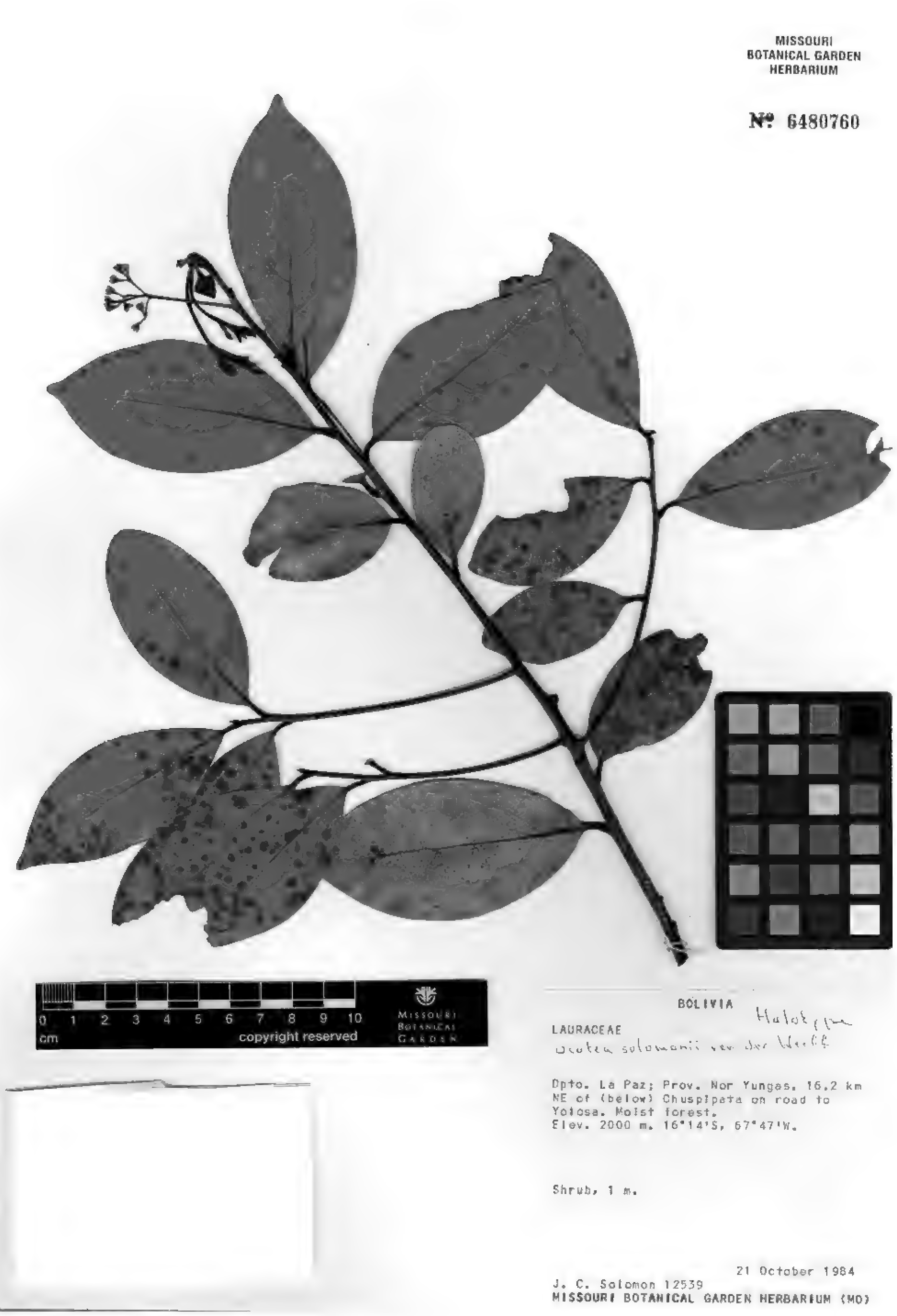


Figure 17. Holotype of *Ocotea solomonii* van der Werff (*J. Solomon 12539*, MO).

Ocoteae monzonensis van der Werff similis, sed gemmis glabris et foliis coriaceis abaxialiter subglaucis recedit.

Shrubs or small trees to 3 m; twigs terete, 2–3 mm diam., glabrous; terminal buds glabrous. Leaves 5–9 × 2.3–3.5 cm, alternate, firmly chartaceous to coriaceous, elliptic, base acute, margin flat, apex acute, midrib, secondary veins and tertiary venation slightly raised on upper leaf surface, more pronouncedly raised on lower surface, tertiary venation

forming a fine reticulum, domatia as axillary tufts of hairs present on lower surface of some leaves, secondary veins 4 to 6 on each side, petioles 4–8 mm, glabrous, flat above. Inflorescences 5–8 cm, glabrous, paniculate cymose, but with few lateral branches. Flowers 2.5–3 mm diam., glabrous on outside, tepals half-erect at anthesis, spreading to reflexed in old flowers, tepals 2 mm, sparsely pubescent on inner surface, united at base; stamens 9, all 4-locular, outer 6 ca. 1 mm, filament with a few hairs at base, about as long as anther, inner 3 stamens ca. 1 mm, locelli opening latrorse, filaments with some hairs and about as long as anthers; staminodia present, ca. 0.5 mm, stipitiform, with a few hairs, large glands present at base of inner stamens; receptacle in old flowers cup-shaped, glabrous inside, pistil starting to develop in a young fruit, 2 mm, glabrous, swollen ovary 1.5 mm. Fruits 12 × 8 mm, cupule bowl-shaped, 7 mm diam. and 2.5 mm high; fruiting pedicel slightly thickened.

Discussion. This is the only Andean *Ocotea* species that has the combination of bisexual flowers, glabrous terminal buds, and domatia as axillary tufts of hairs. The fine reticulation, raised on the lower leaf surface, is also distinctive. This species is described largely on the distinctive significance of the vegetative characters. One collector noted that the leaves were somewhat glaucous on the lower surface; the lower leaf surface of all specimens is covered with minute papillae, only visible with a good dissecting microscope.

Etymology. This species is dedicated to Dr. Jim Solomon, whose fine collections have contributed greatly to our knowledge of the plants of Bolivia.

IUCN Red List category. *Ocotea solomonii* is only known from a rather small area in Bolivia. None of the labels mentioned any local use, and it is unlikely that its wood is used given its small stature. Thus, the only threat will be indiscriminate habitat destruction of which there are no indications. Therefore, it is assessed as Vulnerable (VU), based on IUCN (2001) criteria.

Phenology. Flowers were collected in October, old flowers in February, and fruits from March to June.

Altitudinal distribution. Collections of *Ocotea solomonii* have been made between 1900 and 2600 m in Bolivia.

Paratypes. BOLIVIA. **La Paz:** Nor Yungas, Coroico, 16°11′S, 67°43′W, 2600 m, 27 Mar. 1997, *S. G. Beck 21970* (LPB not seen, MO), *17484* (LPB not seen, MO); Nor Yungas, 16.5 km NE de Chuspipata por el camino a Coroico, 16°13′S, 67°47′W, 1900 m, 28 May 1988, *J. Solomon 18477* (LPB not seen, MO); Nor Yungas, 16.5 km NE de Chuspipata por el camino al Yoloso, 16°13′S, 67°47′W, 1900 m, 18 June 1988, *J. Solomon 18510* (LPB not seen, MO); Sud Yungas, 1 km W de Yanacachi, 2070 m, 30 May 1987, *R. Seidel 987* (MO); Sud Yungas, Chulumani, ladera arriba de Suniquilla Cerro Condorir, 16°25′S, 67°33′W, 2448 m, 29 May 2007, *R. Hurtado & D. Ibáñez 895* (LPB not seen, MO).

29. Ocotea valerioana (Standl.) W. C. Burger, Fieldiana, Bot. 23: 96. 1990. Basionym: *Phoebe valerioana* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 460. 1937. TYPE: Costa Rica. San José, forests of El Copey, Feb. 1898, *A. Tonduz 11746* (holotype, F; isotype, CR not seen).

Tree, to 15 (rarely 20) m; twigs terete or somewhat angular, solid, 2–3 mm diam., densely tomentellous, surface almost completely covered, indument gray-brown or yellowish brown; terminal buds densely tomentellous. Leaves 8–25 × 5–14 cm, alternate, chartaceous or stiffly chartaceous, elliptic, oblong or obovate, pinnately veined, base acute, obtuse or rounded, margin plane, apex acuminate or rounded, acumen to 1 cm long, upper surface sparsely pubescent with mostly erect hairs, soon becoming glabrous, hairs denser along midrib and lateral veins, lower surface moderately to sparsely pubescent with erect hairs, these denser along major veins and discernable to the touch; midrib, lateral veins and tertiary venation immersed or nearly so on upper surface, midrib rather prominently raised, lateral veins and tertiary venation raised on lower surface, domatia lacking, lateral veins 8 to 12; petioles 4–15 mm, flat above, with a similar indument as twigs. Inflorescences 8–30 cm, paniculate cymose, sparsely to moderately pubescent, hairs erect, in axils of leaves or cataphylls. Flowers hermaphroditic, 6–9 mm diam., glabrous, white or yellowish white, fragrant at night; tepals 3–4 mm, inner surface glabrous, with a few hairs near the base or papillose, spreading at anthesis, stamens nine, 4-celled, outer six 1.5–2 mm, cells arranged in 2 pairs, introrse, anthers sessile or with a free filament 1/3 length of stamen, a sterile tip lacking, inner 3 stamens 1.7 mm, cells lateral-extrorse, in 2 rows, glands present at base of filaments, staminodia 3, present, glabrous, to 0.7 mm, pistil 2–2.5 mm, glabrous, style ca. 1 mm, receptacle rather deeply cup-shaped, glabrous inside. Fruits 3 × 1.8 cm, ellipsoid, cupule cup-shaped, 2 cm diam., 1.5 cm high, with a single margin, tepals persistent on young fruits, but deciduous at maturity.

Discussion. *Ocotea valerioana* is similar to *O. macrophylla* from which it differs in the indument of the twigs, consisting of shorter, matted hairs with longer, erect ones in *O. valerioana* and only long, erect hairs in *O. macrophylla*; the shorter matted hairs in *O. valerioana* tend to completely cover the surface of the young twigs, while this surface is at least partly visible in *O. macrophylla*.

Phenology. Flowering specimens of *Ocotea valerioana* have been collected in January, February, March, and November; fruiting specimens in June and August.

Distribution. *Ocotea valerioana* is known from Costa Rica, Panama, Colombia, and Ecuador, at altitudes from 900 to 2000 m.

Selected specimens examined. COLOMBIA. **Antioquia:** Mun. Caldas, *Roldan & Fonnegra 2592* (MO); Boyaca, *Lawrance 217* (MO). **Quindio:** Mun. Filandia, *Vargas 3421* (MO). **Valle:** Mun. Yotoco, *Croat 70677* (MO). ECUADOR. **Carchi:** Espejo, *Palacios 12794* (MO).

30. Ocotea veraguensis (Meisn.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 240. 1889. Basionym: *Sassafridium veraguense* Meisn., DC. Prodr. 15(1): 171. 1864. TYPE: Panama. 1855, *Bridges s.n.* (lectotype, here designated, K [barcode] K000602162).

Trees, to 15 m; twigs terete, 3 mm diam., densely puberulous or appressed pubescent; terminal buds densely puberulous or appressed pubescent. Leaves 6–14 × 3–6 cm, elliptic, alternate, chartaceous, base and apex acute, margin flat, glabrous on both surfaces, venation on upper surface immersed or slightly raised and tertiary venation forming a fine reticulum, slightly raised on lower surface and tertiary venation forming a fine reticulum, domatia lacking, secondary veins 6 to 8 on each side, petioles 8–16 mm, shallowly canaliculate or flat above, with a similar indument as twigs. Inflorescences in axils of bracts or leaves, 1.5–5 cm, paniculate cymose, moderately to sparsely appressed pubescent or inflorescences to 9 cm, flower bearing branches distally often with a foliose bract (to 5 × 2.5 cm) at base; pedicels 1–2 mm, densely pubescent. Flowers white, 6 mm diam., tepals spreading, tepals 2 mm, inner surface densely hairy at base, distally papillose; stamens 9, all 4-locular; outer 6 stamens tongue-shaped, 1.1 mm, filament broad, pubescent, anther papillose, sterile tip 0.2 mm, inner 3 stamens 1.1 mm, with 2 large glands at base, filament 0.6 mm broad, pubescent, anther 0.4 mm wide, narrower than filament, distally papillose, locelli lateral; staminodia present, 0.3 mm, stipitate, densely pubescent; pistil 1.2 mm, glabrous, style 0.3 mm, receptacle deeply cup-shaped, pubescent inside. Fruit 13 × 9 mm, cupule cup-shaped, 6 mm high, with a double margin, outer margin spreading and shorter than inner margin.

Of the three syntypes, *Bridges s.n.* (K) is a good representative of this species. The other two syntypes are *Warszewicz 1* (G not seen) and *Oersted Laur. 10* (B not seen).

Discussion. Distinctive for *Ocotea veraguensis* are the tongue-shaped stamens, papillose inner surface of the tepals and papillose anthers, and cupule with a double margin. The fine reticulation of the leaves is also a distinguishing character. *Ocotea veraguensis* has a wide geographic distribution, from southern Mexico to Peru. In South America, most collections are from below 1000 m, but three Colombian collections are noted from 1000 m and an additional one from 1100 m. This species tolerates drier habitats than most Lauraceae.

Closely related to *Ocotea veraguensis* is *O. quixos* (Lam.) Kosterm., with similar tongue-shaped stamens, papillose tepals and anthers, and cupules with a large double margin. This species occurs in the Amazonian lowlands of Ecuador and the adjoining foothills but always below 1000 m. Crushed leaves and twigs as well as the cupules have a strong odor of cinnamon, and this allows for easy identification. The common name of this species is ishpingo; its cupules are widely sold at markets in Ecuador and used to flavor beverages.

Phenology. This species flowers in May, June, and July; fruits were collected in August, September, and February.

Distribution. *Ocotea veraguensis* ranges in altitudes from sea level to 1100 m.

Selected specimens examined. COLOMBIA. **Risaralda:** *Silverstone-Sopkin & Berrio 7752* (MO). **Valle:** Mun. Buga, *Cuadros 505* (MO). ECUADOR. **Guayas:** Bosque Protector Cerro Blanco, *Rubio et al. 1979* (MO). PERU. **Tumbes:** Distr. Matapalo, *Vargas 43 JVA* (MO).

31. Ocotea vergelensis van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe, Palanda. Rio Vergel valley, along rd. Palanda–La Canela, 04°36′S, 78°58′W, 1500 m, 13 Nov. 2006 (fl.), *H. van der Werff, B. Gray & V. Placencia 22049* (holotype, MO-6446523; isotypes, B, F, G, GH, HUT, K, LOJA, NY, P, QCNE, US). Figure 18.

Ocoteae cuspidatae van der Werff affinis, sed ab ea foliis alternis majoribus basi acutis (non decurrentibus) apice acutis (non acuminatis) recedit.



Figure 18. Holotype of *Ocotea vergelensis* van der Werff (*H. van der Werff, B. Gray & V. Placencia 22049*, MO).

Trees, to 17 m; twigs angular, 3–5 mm diam., moderately appressed pubescent, terminal buds densely appressed pubescent. Leaves 11–23 × 5–10 cm, alternate, elliptic firmly chartaceous to coriaceous, base acute to obtuse, margin flat, apex acute, glabrous on both surfaces, venation immersed on upper surface, midrib raised, secondary veins slightly raised and tertiary venation immersed on lower surface; secondary veins 7 to 9 on each side, domatia lacking, petioles 10–16 mm, canaliculate,

with a similar indument as twigs. Inflorescences in axils of leaves or bracts, 12–30 cm, moderately appressed pubescent, paniculate cymose, laxly flowered; pedicels 1.5–2 mm. Flowers yellow, 2–3 mm diam., outside appressed pubescent, tepals erect, 1 mm, outside and inside sparsely pubescent, stamens 9, all 4-locular, outer six 1 mm, pubescent filaments 0.3 mm, anther glabrous, inner 3 stamens 0.9 mm, pubescent filament 0.3 mm, filaments only slightly narrower than anthers, glands present at base of inner stamens, staminodia present, 0.5 mm, pubescent, stipitiform; pistil glabrous, 1.8 mm, style as long as ovary, receptacle deep, pubescent inside. Fruits ellipsoid, 2.5 × 1.5 cm, cupules deeply cup-shaped, 1.7 cm diam., 1.2 cm high, with a single margin; tepals deciduous in fruit.

Discussion. The erect tepals and relatively long pedicels indicate that *Ocotea vergelensis* is closely related to *O. cuspidata*. The two species differ in leaf size (to 14 cm long in *O. cuspidata* vs. to 23 cm in *O. vergelensis*), leaf position (subopposite vs. alternate), leaf apex (acuminate in *O. cuspidata* vs. acute in *O. vergelensis*) and inflorescence size (to 8 cm long in *O. cuspidata* vs. to 30 cm long in *O. vergelensis*). Both species occur in southern Ecuador, but *O. vergelensis* is also known from northern Peru.

Ocotea vergelensis belongs to the *O. aciphylla* group and is set apart from the other species of the group by its relatively large leaves and sparsely pubescent flowers. The fruiting specimens also have sparsely lenticellate twigs, although lenticels are not visible on the young twigs of the flowering specimens.

Both flowering collections have some cylindrical fruitlike structures crowned with persistent tepals mixed in with the flowers. These so-called fruits are galls, hollow inside with an insect larva that causes the gall. These galls are more common in the type collection. Similar galls have not been found in related *Ocotea* species from southern Ecuador or northern Peru. Insect larvae are often present in other Lauraceae flowers, without causing galls (van der Werff, pers. obs.).

Distribution. The new species has been collected in Ecuador and Peru from 1200 to 2000 m.

IUCN Red List category. Ocotea vergelensis is only known from five recent collections and is given an assessment of Data Deficient (DD), based on IUCN (2001) criteria.

Phenology. The two flowering collections were made in August and November.

Paratypes. ECUADOR. **Zamora-Chinchipe:** Nangaritza Canton, Pachicutza, camino al Hito, 04°07′S, 78°37′W, 1200–1300 m, 20 Oct. 1991, *W. Palacios & Exp. Tratado Coop. Amazonica 8389* (MO). PERU. **Amazonas:** near border with Dept. San Martin, 05°41′S, 77°48′W, 2000 m, 3 Apr. 2001, *H. van der Werff, R. Vásquez, B. Gray & J. Campos 16658* (MO). **Cajamarca:** San Ignacio, Distr. Huarango, Caserio Selva Andina, 05°03′10″S, 78°45′01″W, 1870 m, 15 Aug. 2006 (fl.), *J. Perea & V. Flores 2644* (MO). **San Martin:** Rioja Prov., Pedro Ruiz–Moyabamba Rd., Venceremos, 05°50′S, 77°45′W, 1800–1900 m, 29–31 July 1983, *D. Smith 4482* (MO).

32. Ocotea weberbaueri Mez, Bull. Herb. Boissier, Sér. 2, 5: 236. 1905. TYPE: Peru. Puno, Oberhalb des Tambo Cachicachi (Weg von Sandia nach Chunchusmayo) 1800–2000 m, 26 July 1902, *A. Weberbauer 1309* (holotype, B).

Shrubs, to 3 m; twigs terete, 2–3 mm diam., moderately appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 3–9 × 1.2–3 cm, alternate, elliptic, firmly chartaceous, often falcate and conduplicate, base obtuse or acute, margin flat or slightly revolute near base, apex acute or acuminate, glabrous or with a few hairs along major veins on lower surface, venation immersed on both surfaces or tertiary, reticulate venation weakly raised on lower surface; domatia absent; secondary veins poorly visible, 5 to 7 on each side; petioles 3–5 mm, canaliculate, glabrous or nearly so. Inflorescences 1–3 cm, racemose or with a few cymes near base and distally racemose, in axils of bracts along leafless short shoots, moderately to sparsely appressed pubescent. Flowers ca. 3 mm diam., pale yellow, hypanthium moderately to sparsely appressed pubescent, tepals 1 mm, sparsely pubescent to glabrous outside, sparsely pubescent on the inner surface, slightly papillose toward tip; half-erect at anthesis, spreading in old flowers; stamens 9, all 4-locular, outer 6 stamens 0.8 mm, anther 0.7 mm, short filament and base of anther with a few hairs, inner 3 stamens 1 mm, filament 0.2 mm and with a few hairs, glands present at base of inner stamens, staminodia present, 0.5 mm, cylindrical, with a few hairs near base; pistil glabrous, 1.5 mm, ovary gradually narrowed in style; receptacle deep, glabrous inside. Fruits and cupules not known.

Discussion. Ocotea weberbaueri can be recognized by its small, falcate, and conduplicate leaves and its short, racemose inflorescences found in the axils of bracts near the tips of the branches or along leafless short shoots. Rohwer (1986) placed this species in the *O. aciphylla* group with which I agree. Two collections from the Cusco Department (*Dudley*

10860, NY, F; and *10870*, F) probably represent this species as well, but differ in having regular, flat leaves (not falcate and conduplicate) and inflorescences in the axils of leaves, not bracts. *Galiano et al. 6401* (MO) is vegetatively similar to *O. weberbaueri*, but comes from a 20-m tree; it has young fruits almost completely enclosed in the longitudinally ribbed cupule with persistent tepals. These three collections are treated as *O. weberbaueri* vel aff. Rohwer (1986) placed the type locality (Tambo Cachicachi along the road from Sandia to Chunchusmayo) in the Department of Madre de Dios. This is an error; the type locality is in the Department of Puno and is outlined in Pintaud et al. (2010: 163) in their report on the type locality of *Ceroxylon weberbaueri* Burret ("between Tambo Yuncacocha and Tambo Cachicachi along the road from Sandia to Chunchusmayo"). Weberbauer did not always mention the departments where he collected and there is more than one locality with the name Chunchusmayo in Peru.

Phenology. *Ocotea weberbaueri* has been collected with flowers in July and September.

Distribution. This species is known from 1800 to 3000 m.

Additional specimen examined. PERU. **Cusco:** La Convención, Distr. Quellouno, Yavero, 12°35′35″S, 72°23′21″W, 2980 m, 27 Sep. 2006, *L. Valenzuela 7754* (AMAZ not seen, CUZ not seen, HUT not seen, MO, MOL not seen, USM not seen).

33. Ocotea whitei Woodson, Ann. Missouri Bot. Gard. 24: 188. 1937. TYPE: Panama. Chiriqui, vic. Monte Lirio, 1300–1900 m, 27 June–13 July 1935, *R. J. Seibert 307* (holotype, MO-1110036).

Trees, to 40 m; twigs ridged or angular, 3 mm diam., sparsely to moderately appressed pubescent, soon becoming glabrous; terminal buds densely appressed pubescent. Leaves 5–15 × 2–6 cm, alternate, elliptic to narrowly elliptic or obovate, alternate, firmly chartaceous to coriaceous, base attenuate, somewhat decurrent on petiole, margin flat or slightly revolute, apex acute, less frequently obtuse, upper surface glabrous, lower surface appressed pubescent or sparsely so, midrib, secondary veins and tertiary venation immersed or slightly raised on upper surface, somewhat more raised on lower surface, domatia present as axillary tufts of hairs, rarely absent, secondary veins 6 to 10 on each side, petioles 5–15 mm long, sometimes poorly defined due to decurrent leaf blades, shallowly canaliculate, with a similar indument as twigs. Inflorescences 6–15 cm, paniculate cymose, in axils of normal leaves, moderately to sparsely appressed pubescent, branchlets flattened. Flowers 2–3 mm diam., creamy or green, tepals 1.5 mm, ovate, densely pubescent outside, sparsely to moderately pubescent inside, half-erect at anthesis, outer 6 stamens 0.8 mm, filament pubescent, 0.3 mm, dorsally pubescent, cells opening introrse, inner 3 stamens 0.8 mm, filaments a little shorter than anthers, dorsally pubescent, cells opening extrorse-lateral, glands present at base of filaments of inner 3 stamens, staminodia not seen, pistil 1 mm, glabrous, style about as long as ovary, receptacle glabrous inside, cup-shaped. Fruits 4.5 × 2.5 cm, ellipsoid, cupule initially cup-shaped, but platelike at maturity, 1.3 cm diam., with a simple margin.

Discussion. *Ocotea whitei* belongs to the *O. insularis* group as defined by van der Werff (2002) because of its flattened inflorescence branches and the patch of white hairs facing the pistil at the junction of filament and anther of the inner three stamens. The only other species of this predominantly Central American group occurring in South America is *O. insularis*. *Ocotea whitei* differs from *O. insularis* in its smaller leaves (5–15 × 2–6 cm vs. 8–27 × 5–14 cm), its white pubescent flowers, and larger fruits (to 4.5 × 2.5 vs. 2 × 1 cm) with a platelike cupule (not shallowly bowl-shaped). Although *O. whitei* lacks striking characteristics, it can grow to a large tree (to 40 m); its large size might explain the paucity of collections of this species in the Andean region.

Habitat and distribution. *Ocotea whitei* has been collected from 900 to 1800 m and is distributed through Nicaragua, Costa Rica, Panama, Venezuela, Ecuador, and Peru.

Phenology. Flowers were collected in August and November; fruits in November.

Selected specimens examined. ECUADOR. **Carchi:** Espejo, Rio Golondrinas, *Palacios 12805* (MO). **Imbabura:** Cotacachi, Cordillera de Toisan, *Clark 7377* (MO). **Pichincha:** Along rd. Nanagal–Palmitopampa, *H. van der Werff, B. Gray & G. A. Tipaz 12273* (MO, QCNE). **Zamora-Chinchipe:** along rd. from mining camp to Quimi valley, *H. van der Werff, B. Gray, J. C. Ronquillo & W. Quizhpe 19552* (MO). PERU. **San Martin:** Km. 291 on Rioja–Pomacocha rd., *A. H. Gentry, D. N. Smith & S. Vásquez S. 45506* (MO).

Imperfectly Known Species

Ocotea balanocarpa (R. & P.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 388, 1889. Basionym: *Laurus balanocarpa* R. & P., Fl. Peruv. 4, t.

354, 1804, *Mespilodaphne balanocarpa* (R. & P.) Nees, *Linnaea* 21: 495, 1848. TYPE: Peru, in Andium Peruviae Nemoribus, *H. Ruiz s.n.* (type, B, BM not seen, F not seen, G not seen, P).

This species is only known from the type collection, which consists of a leafy twig and detached fruits. Rohwer (1986) included it in the *Ocotea aciphylla* group. As long as flowers are not known, it is best listed among the incompletely known species.

Ocotea stuebelii Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 245, 1889. TYPE: Colombia, "in summis montis Cerro Pelado," 2684 m, Dec. 1868–Jan. 1869, *Stuebel 249a* (holotype, B).

This species is only known from the holotype, a specimen with very few flowers. Leaves are elliptic, acuminate (to 9 × 3.5 cm) with an inrolled margin. I have not seen other specimens like it. Rohwer (1986) placed it in his *Ocotea aciphylla* group with which I agree. I feel that flowers of a type specimen like this should only be dissected if comparable specimens with additional flowers are available. Until such time, I regard *O. stuebelii* as an incompletely known species.

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Appendix 1. List of Exsiccatae Examined

Collections are listed alphabetically by collector, and type collections are in boldface. The numbers in parentheses or brackets correspond to the numbers of the species treatment in the text and in the List of Species.

List of Species

1. *Ocotea aciphylla* (Nees & Mart.) Mez
2. *O. albida* Mez & Rusby
3. *O. alveata* van der Werff
4. *O. caesifolia* van der Werff
5. *O. celastroides* (Meisn.) Mez
6. *O. choquetangensis* van der Werff
7. *O. comata* van der Werff
8. *O. condorensis* van der Werff
9. *O. cuscoensis* van der Werff
10. *O. cuspidata* van der Werff
11. *O. fusagasugensis* van der Werff
12. *O. gymnoblasta* van der Werff
13. *O. hammeliana* van der Werff
14. *O. heterochroma* Mez & Sodiro
15. *O. insularis* (Meisn.) Mez
16. *O. latipetiolata* van der Werff
17. *O. limiticola* van der Werff
18. *O. longipetiolata* van der Werff
19. *O. macrophylla* Kunth
20. *O. mollivillosa* van der Werff
21. *O. monzonensis* Mez
22. *O. munacensis* O. C. Schmidt
23. *O. pacifica* van der Werff
24. *O. pedanomischa* van der Werff
25. *O. pichinchensis* van der Werff
26. *O. piurensis* Mez
27. *O. smithii* van der Werff
28. *O. solomonii* van der Werff

29. *O. valerioana* (Standl.) W. C. Burger
30. *O. veraguensis* (Meisn.) Mez
31. *O. vergelensis* van der Werff
32. *O. weberbaueri* Mez
33. *O. whitei* Woodson

Albert 2451 (29), *Apaza 1064* (2), *1096* (2), *Araujo-Murakami 3513* (2), *3619* (2), *3622* (2).

Bang 841 (2), ***1550*** (2), *1572* (2), *Beck 17484* (28), *21970* (28), *22268* (7), *Berg 22* (23), *BMA 162* (2), *164* (2), *Boeke 2625* (14), *Bonpland* ***s.n.*** (19), *Breteler 4928* (19).

Cabrera 6632 (23), *Calatayud 2229* (2), *Callejas 5101* (15), *Campos 5694* (25, *5923* [16|, *6596* [24|), *Caranqui* ***239*** (17), *655* (14), *1632* (14), *Cerna 411* (10), *Ceron 10077* (23), *20067* (30), *Clark 925* (23), *4984* (23), *7377* (33), *Cogollo 2536* (15), *3274* (29), *3286* (29), *4210* (15), *6053* (29), *6118* (23), *6634* (29), *6676* (29), *6859* (29), *7888* (23), *Cornejo 1071* (7), *Croat 70677* (29), *Cuadros 497* (30), *505* (30), *995* (30), *997* (30), *Cuatrecasas 20410* (14), *20593* (14), *Cueva 521* (24).

Davila 30 (9), *Devia 329* (30), *1948* (14), *5503* (30), *5542* (30), *Diaz 2079* (26), *4698* (26), *4803* (26), *4897* (26), *5785* (26), *7476* (26), *7478* (26), *Diaz P. 3982* (30).

Fernandez 7 (29), *45* (23), *Foster 9030* (24), *Freire 4348* (17), *4372* (17), *Fuentes 10885* (7), *12246* (7), *14406* (2), ***14843*** (7), *15489* (7), *15583* (2).

Galiano ***6466*** (3), *Gentry 53214* (15), *Giraldo Cañas 287* (29), *Giraldo-Gensini 209* (15), *Giraldo 51* (15).

Hammel ***17179*** (13), *Hernani 360* (24), *388* (2), *Holm-Nielsen 24465B* (15), *Homeier 326* (24), *530* (1), *993* (1), *2197* (15), *5114* (24), *984* (24), *1217* (24), *1247* (24), *4259* (24), *Huamán 11* (1), *27* (1), *37* (16), *41* (10), *43* (10), *Huamantupa* ***2353*** (20), ***4354*** (4), *6667* (4), *6781* (4), *Huaylla 2902* (2).

Jaramillo 5348 (14), *8984* (14), *14478* (15).

Krukoff 11040 (2), *11069* (2), *11220* (2), *11205* (2).

Lawrance 217 (29), *728* (23), *281* (29).

Menzies ***s.n.*** (15), *Monteagudo 4476* (2), *8094* (24), *12887* (2), *16048* (24), *16068* (24).

Neill 13025 (17), *13223* (15), *13718* (24), *Núñez 8639* (20).

Ortiz 536 (15).

Palacios 3661 (14), *3699* (14), *4352* (15), *4372* (15), *4847* (15), *6541* (10), ***6544*** (10), *6580* (1), *6813* (15), *7351* (15), *8389* (31), *12794* (29), *12805* (33), *Pennington 17865* (24), *Perea 2644* (31), *3475* (1), *Pipoly 16550* (29), *17008* (29), *17038* (29), *Purdie* ***s.n.*** (5).

Quelal 2 (25), *126* (15), *502* (15), *Quizhpe* ***2645*** (18), *2805* (1).

Ramos 3473 (30), *Rodriguez 2638* (17), *2870* (24), *Rojas 2093* (24), *3621* (24), *Roldan 2592* (29), *Rubio 582* (15), *593* (15), *1740* (33), *1979* (30), *Ruiz Teran 1558* (19).

Salinas ***2521*** (6), *2697* (6), *Sanchez 1371* (19), *1891* (29), *Sanchez-Vega 9910* (1), *Sarmiento 335* (11), *Seibert* ***307*** (33), *Seidel 987* (28), *Silva 631* (9), *631A* (9), *Silverstone-Sopkin 3495* (30), *5943* (30), *6086* (30), *6281* (30), *6317* (30), *7631* (30), *7663* (30), *7752* (30), *8661* (30), *Smith 4482* (31), *13062* (7), ***13918*** (27), *Sodiro* ***143/6b*** (14), *Soejarto* ***366*** (11), *Solomon* ***12539*** (28), *18477* (28), *18510* (28).

Tipaz 804 (30), *Tirado 890* (10), *892* (15), *Toasa* ***8952*** (8).

Valenzuela 665 (12), ***744*** (12), *4718* (20), *4880* (20), *6938* (2), *6944* (2), *7754* (32), *7833* (2), *8092* (2), *9980* (2), *10065* (2), *11752* (24), *12608* (18), *Vargas 43* (30), *1617* (15), *3000* (14), *3060* (19), *3299* (15), *3345* (15), *3421* (29), *3536* (15), *4977* (19), *5371* (15), *6560* (14), *7969* (14), *8074* (15), *8501* (14), *8861* (14), *Vásquez 20533* (26), *28624* (24), *30767* (24), *32410* (18), *32726* (24), *34473* (24).

Weberbauer ***1309*** (32), ***3712*** (21), *6348* (26), *6352* (26), *6428* (26), ***6794*** (22), *van der Werff 8996* (24), *9001* (24), *9558* (15), *9562* (23), *10715* (15), *10772* (29), *10865* (15), *12170* (15), *12188* (15), *12247* (15), *12263* (15), ***12269*** (23), *12273* (33), *12282* (15), *12284* (23), *13363* (14), *13386* (25), ***13401*** (25), *16658* (31), *16902* (24), *19023* (1), *19552* (33), *19577* (1), ***22049*** (31), *21806* (24), *21857* (24), *22688* (24), *22692* (24), *22849* (24), *22867* (24), *22884* (24), ***22886*** (24), *22928* (24), *23432* (24), *Wisum 752* (1), *1063* (15).

Zak 2473 (14), *Zarucchi 7118* (15), *7132* (15).

Primulina carinata (Gesneriaceae), A New Species from Guangxi, China

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Abstract. *Primulina carinata* Y. G. Wei, F. Wen & H. Z. Lü (Gesneriaceae) is described and illustrated as a new species endemic to Guangxi, China. It is similar to *P. parvifolia* (W. T. Wang) Yin Z. Wang & J. M. Li, but can be distinguished by its lack of stolons, by its longer peduncle 12–20 cm or more (vs. 5.3–5.6 cm in *P. parvifolia*), by the longer pedicels 10–12 mm (vs. ca. 8 mm), by the ventral surface of the corolla tube longitudinally constricted, forming a keel (vs. the upper portion of corolla tube swollen, forming an elevated ridge), by the staminal filaments sparsely glandular puberulent (vs. glabrous), and by three staminodes (vs. two), with the lateral two at different lengths, ca. 4 mm and ca. 2 mm (vs. the staminal pair at equal length, ca. 5 mm).

Key words: China, Gesneriaceae, Guangxi, IUCN Red List, *Primulina*.

Recently, the described species of *Chiritopsis* W. T. Wang and *Chirita* sect. *Gibbosaccus* C. B. Clarke, as well as two species of *Wentsaiboea* D. Fang & D. H. Qin, were merged within *Primulina* Hance (Möller et al., 2011; Wang et al., 2011; Weber et al., 2011; Xu et al., 2012). Thus, this originally monotypic genus has dramatically increased in size, with at least 140 species and nine varieties (Weber et al., 2011, 2013; Möller et al., 2013; Wen et al., 2013). Following examination of specimens collected in 2007 from Guangxi, China, we discovered an evidently rare species of *Chirita* Buch.-Ham. (now *Primulina*) in Wuming County, central Guangxi. Many species of *Primulina* (formerly in *Chirita* sect. *Gibbosaccus*) were reported in the past few years from Guangxi and adjacent provinces (Li & Wang, 2008; Xu et al., 2008; Li & Möller, 2009; Wen et al., 2009; Huang et al., 2010; Xu et al., 2010; Tang & Wen, 2011; Huang et al., 2011). After carefully consulting specimens and literature related to these known species, including local and national floras on *Primulina* in neighboring regions (Wood, 1974; Wang, 1985, 1990; Wang et al., 1998; Nguyen & Kiew, 2000; Burtt, 2002; Li & Wang, 2004; Wei et al., 2010) and including the study of herbarium material, we have concluded that the Guangxi taxon represents a new species, which is described and illustrated herein. In addition, living plants were collected and cultivated and are currently cultivated in the greenhouse at the Guangxi Institute of Botany for ex situ conservation of this rare and poorly known species.

Primulina carinata Y. G. Wei, F. Wen & H. Z. Lü, sp. nov. TYPE: China. Guangxi Zhuang Autonomous Region: Wuming Co., Chengxiang town, growing in transverse crevice of cliff, on top of a limestone hill, 22 Sep. 2007, *F. Wang & Y. G. Wei WM-GC0702* (holotype, IBK; isotype, MO). Figure 1.

Chirita vesiculosum Y. G. Wei, Fang Wen & H. Z. Lü, nom. nud. (Wei et al., 2010: 490–491, figs. 1–3).

Haec species *Primulinae parvifoliae* (W. T. Wang) Y. Z. Wang & J. M. Li affinis, sed ab ea stolonibus nullis, pedunculis longioribus 12–20 (vel plus) cm longis, pedicellis longioribus 10–12 mm longis, corollae tubo inferne longistrorsum constricto carinam formante, filamentis glanduloso-puberulis atque staminodiis 3 duobus lateralibus inaequalibus ca. 4 mm longis et ca. 2 mm longis mediano 0.8–1 mm longo distinguitur.

Herbs perennial, stemless; rhizome 35–84 mm, 4.5–6.5 mm diam., infrequently sprouting from

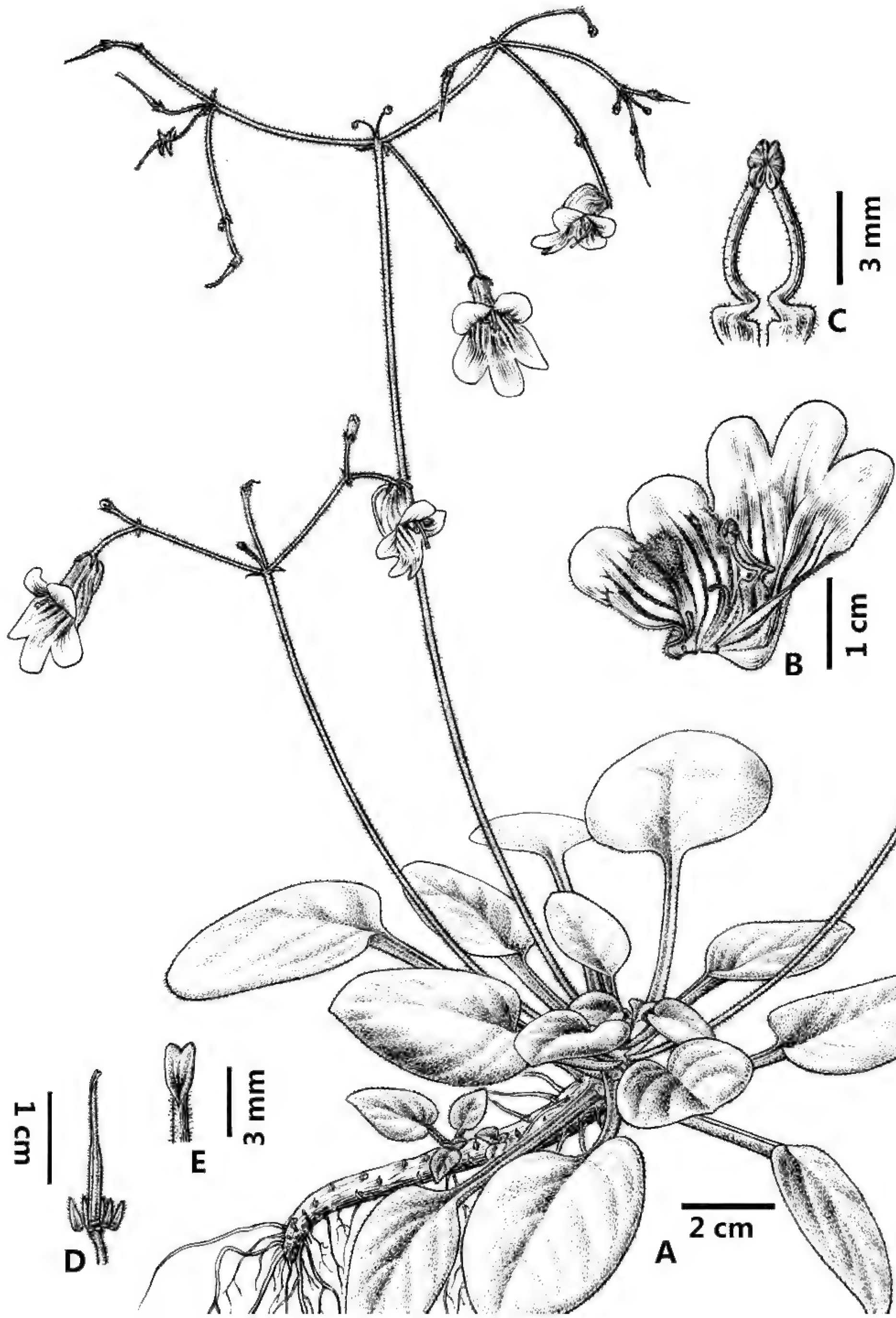


Figure 1. *Primulina carinata* Y. G. Wei, F. Wen & H. Z. Lü. —A. Habit. —B. Corolla dissected open to show stamens and staminodes. —C. Stamens geniculate near the base. —D. Calyx and pistil, with corolla tube removed. —E. Close-up of stigmatic region. Drawn by Y. X. Zhu from the holotype *F. Wen & Y. G. Wei WM-GC0702* (IBK).

rhizome node. Leaves 9 to 15 or more, commonly clustered at rhizome apex, with 3 leaves per whorl; petioles flattened, 18.5–58.5 × 4–4.5 mm, densely appressed puberulent; blades carnose or leathery, papery when dry, broadly elliptic to ovate, 40–50 × 30–40 mm, dense, white appressed puberulent, base rounded, margin entire, apex obtuse; lateral veins 3 to 5, inconspicuous. Cymes lax, 3 to 5 per rosette,

axillary, 1- or 2-branched, each 6- to 12-flowered or more; peduncle 12–20 cm or longer, densely appressed puberulent; bracts 2, opposite, subulate to lanceolate, 4–5 × 1–1.5 mm, margin entire, appressed puberulent; pedicel 10–12 mm, dense, erect brownish glandular puberulent. Flower with calyx 5-lobed, dissected to near base, base slightly united, calyx segments nearly equal, narrowly lanceolate, 1.2–1.3 × 0.35–0.4 mm, apex acute, externally pubescent, internally glabrous, margins entire; corolla purple or purplish red, externally and internally with purplish brown stripes, 20–27 mm, externally sparsely puberulent, internally glabrous; corolla tube narrowly funnelform, 8–11 mm, ventral surface longitudinally constricted, forming clearly carinate; limb distinctly 2-lipped, purple, adaxial lip ca. 5.5 mm, 2-parted to base, lobes 8–9 mm wide; abaxial lip 10–13 mm, 3-parted to near middle, lobes rounded-ovate, 7.2–7.8 mm wide; stamens 2, adnate to ca. 5 mm above corolla base; filaments lanceolate-subulate, 6.5–8 mm, geniculate near base, sparsely glandular puberulent; staminodes 3, the lateral two unequally long, longer staminode ca. 4 mm, curved, adnate 5–5.4 mm above corolla base, shorter staminode ca. 2 mm, straight, adnate to 2–2.5 mm above corolla base, both sparsely glandular puberulent, linear, apex capitate; middle staminode 0.8–1 mm long, adnate to corolla tube base, glabrous; disc annular, ca. 1 mm high, glabrous; pistil ca. 15–17 mm, ovary linear, 9–10 × 1.5–1.6 mm, puberulent; style 6–6.5 mm, densely glandular puberulent; stigma obtrapezoid, ca. 2.6 mm, 2-lobed. Capsule linear.

Distribution and ecology. Only one population of *Primulina carinata* was found in the crevices of a steep cliff near the top of a limestone hill in Wuming County, Guangxi, China, at ca. 114 m in elevation.

IUCN Red List category. Only a single population with ca. 30 individuals is known to exist at the type locality. All individuals were found growing in a large horizontal crevice close to the top of the limestone hill of a karst tower. The hill is isolated by paddy fields. We therefore assess *Primulina carinata* as Critically Endangered (CR), according to IUCN Red List criteria (IUCN, 2001). The CR category assessment of this new species is based on the distributional range that extends ca. 5 km^2 around the type locality at present, as observed in the past three years.

Phenology. The flowering specimens of *Primulina carinata* have been collected from August to September; fruiting occurred in October.

Etymology. *Primulina carinata* is named for the corolla tube with the ventral keel that superficially resembles a cariniform shape.

Primulina carinata is easily distinguished from all other species of *Primulina* by its special flower structure. The ventral surface of the corolla tube is longitudinally constricted, to form a distinct carinate shape. This new species is morphologically similar to *P. parvifolia* (W. T. Wang) Yin Z. Wang & J. M. Li in having similar vegetative structures, for example, the broadly elliptic to ovate leaf blades. *Primulina parvifolia* occurs in Guigang, in Guangxi Zhuang Autonomous Region, China. The distributional areas of these two species are not far from each other, only ca. 180 km apart. However, the new taxon differs from *P. parvifolia* by having a more slender and longer peduncle 12–20 cm (vs. a shorter one, only 5.3–5.6 cm) and longer pedicles 10–12 cm (vs. ca. 8 mm), by the longitudinally carinate ventral surface of the corolla tube that forms a keel (vs. the corolla tube swollen dorsally to form an elevated ridge in the other species), by the three staminodes (vs. two), with the lateral two dissimilar in length, ca. 4 mm and ca. 2 mm, respectively (vs. only two staminodes of similar length, ca. 5 mm).

Paratypes. CHINA. **Guangxi Zhuang Autonomous Region:** Wuming Co., Chengxiang town, Dengliu village, in transverse crevice of cliff, on top of a limestone hill, 27 Sep. 2007 (fl.), *F. Wen & Y. G. Wei WM-GC0703*; 20 Sep. 2008, *F. Wen WM0801* (IBK, MO).

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New Names and Combinations in Indian Acanthaceae

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ABSTRACT. A wider concept of *Justicia* L. and *Strobilanthes* Blume (Acanthaceae) is now generally accepted as the characters used to distinguish related genera, namely an elastic placenta and greater ovule numbers, are not diagnostic and appear to be derived characters. In consequence the following new combinations are needed to bring the names of Indian species into line with currently accepted generic limits: *J. apiculata* (Bedd.) J. R. I. Wood [≡ *Rungia apiculata* Bedd.], *J. himalayensis* (C. B. Clarke) J. R. I. Wood [≡ *Rungia himalayensis* C. B. Clarke], *J. latior* (Nees) J. R. I. Wood subsp. *latior* [≡ *Rungia longifolia* subsp. *latior* (Nees) Cramer], which results in the new varietal combination of *J. latior* var. *anamalayana* (Chandrab. & V. Chandras.) J. R. I. Wood, *J. latior* subsp. *longifolia* (Nees) J. R. I. Wood [≡ *Rungia longifolia* Nees subsp. *longifolia*], *J. mastersii* (T. Anderson) J. R. I. Wood [≡ *Rungia mastersii* T. Anderson], *J. wightiana* (Nees) J. R. I. Wood [≡ *Rungia wightiana* Nees], *Strobilanthes alternata* (Burm. f.) E. Moylan ex J. R. I. Wood [≡ *Hemigraphis alternata* (Burm. f.) T. Anderson], *Strobilanthes brunelloides* (Lam.) J. R. I. Wood [≡ *Hemigraphis brunelloides* (Lam.) Bremek.], *Strobilanthes cordifolia* (Vahl) J. R. I. Wood [≡ *Stenosiphonium cordifolium* (Vahl) Alston], *Strobilanthes crossandra* (Steud) J. R. I. Wood [≡ *Hemigraphis crossandra* (Steud.) Bremek.], *Strobilanthes pavala* (Roxb.) J. R. I. Wood [≡ *Hemigraphis latebrosa* (Heyne ex Roth) Nees], *Strobilanthes urens* (Roth) J. R. I. Wood [≡ *Hemigraphis urens* (Roth) J. R. I. Wood], *Strobilanthes venosa* (Heyne ex C. B. Clarke) J. R. I. Wood [≡ *Hemigraphis venosa* Heyne ex C. B. Clarke], *Strobilanthes wightii* (Bremek.) J. R. I. Wood [≡ *Stenosiphonium wightii* Bremek.]. The following new names are also provided for species where the epithet cannot be transferred as it is blocked by a pre-existing epithet in the genus: *J. concinna* J. R. I. Wood [≡ *Rungia elegans* Dalzell & Gibson], *J. crenatifolia* J. R. I. Wood [≡ *Rungia crenata* T. Anderson], *J. eudoxa* J. R. I. Wood [≡ *Rungia laeta* C. B. Clarke], *J. heyneana* J. R. I. Wood [≡ *Rungia linifolia* Nees], this new name resulting in the new varietal combination *J. heyneana* var. *saldanhae* (Mascar. & Janarth.) J. R. I. Wood, *J. meghalayana* J. R. I. Wood [≡ *Rungia khasiana* T. Anderson] and *J. vallis-silentiosae* J. R. I. Wood [≡ *Rungia sisparensis* T. Anderson ex C. B. Clarke], *Strobilanthes carinei* J. R. I. Wood [≡ *Stenosiphomium setosum* T. Anderson], and *Strobilanthes sinuata* J. R. I. Wood [≡ *Hemigraphis repanda* (L.) Hallier f.]. Lectotypes are designated for the following basionyms: *Haplanthodes neilgherryensis* (Wight) R. B. Majumdar, *Hemigraphis latebrosa* var. *rupestris* C. B. Clarke, *Hemigraphis platycarpos* C. B. Clarke, *Hemigraphis venosa* Heyne ex C. B. Clarke, *Ruellia alternata* Burm. f., *Ruellia confinis* Nees, *Ruellia confinis* var. β, *Ruellia diffusa* Nees, *Ruellia ebracteata* Dalzell, *Ruellia elegans* Hook, *Ruellia pavala* Roxb., *Ruellia repanda* L., *Ruellia urens* Roth, *Rungia apiculata* Bedd., *Rungia himalayensis* C. B. Clarke, *Rungia linifolia* Nees, *Rungia khasiana* T. Anderson, *Rungia sisparensis* T. Anderson ex C. B. Clarke, *Rungia wightiana* Nees, *Stenosiphonium confertum* Nees, *Stenosiphonium subsericeum* Nees, *Stenosiphonium wightii* Bremek., and *Strobilanthes burmanica* Kurz. Neotypes are provided for *Rungia elegans* Dalzell and *Ruellia latebrosa* Heyne ex Roth. The opportunity is taken to recognize *Haplanthus neilgherryensis* Wight formally as variety *neilgherryensis* (Wight) J. R. I. Wood, with the variety transferred from *Haplanthodes tentaculatus* (L.) Nees.

Key words: Acanthaceae, *Haplanthodes*, *Hemigraphis*, *Justicia*, *Ruellia*, *Rungia*, *Stenosiphonium*, *Strobilanthes*.

In order to provide users with names in accord with current generic concepts in Acanthaceae, new names and taxonomic transfers are required for the Checklist of the Indian Flora now under preparation by Missouri Botanical Garden and its collaborators in India. These changes affect the genera *Haplanthodes* Kuntze, *Justicia* L., and *Strobilanthes* Blume.

Species previously placed in *Rungia* Nees were separated from *Justicia* by the presence of an elastic placenta, which rises up as it separates from the ripening capsule wall. This character occurs occasionally in both *Justicia* itself (Hansen, 1989) and *Strobilanthes* (Wood, 1994b) as well as a number of other genera discussed by Darbyshire and Vollesen

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(2007). It is the only distinction between *Dicliptera* Juss. and *Peristrophe* Nees as well as between *Rungia* and *Justicia*, and no other morphological or molecular evidence has been found to justify separation of either of these genus pairs. A recent paper (Darbyshire & Vollesen 2007: 120) suggested that "placental elasticity was a derived character having arisen on several occasions in the family's (i.e., Acanthaceae) evolution" and went on to unite *Peristrophe* with *Dicliptera*, a decision that has been followed by Indian botanists (Karthikeyan et al., 2009). The unsatisfactory status of *Rungia* was indicated by Hansen (1989) as well as Darbyshire and Vollesen (2007). In the recent account of *Justicia* for the *Flora of Tropical East Africa*, species of *Rungia* were transferred to *Justicia* (Vollesen, 2010). It seems, therefore, appropriate to bring the Indian species into line with these changes.

In the case of *Strobilanthes* a wide concept of this genus is now generally accepted so that the entire Strobilanthineae sensu Bremekamp (1944) is included within *Strobilanthes*. Carine and Scotland (2002) and Moylan et al. (2004) demonstrated that the segregate genera recognized by Bremekamp (1944) and his followers cannot be maintained either on morphological or molecular grounds, and the process of transferring species from the segregate genera begun by Wood and Scotland (2009) and Deng et al. (2010) needs to be applied to species occurring in India, namely those placed in *Hemigraphis* Nees and *Stenosiphonium* Nees. This will bring the Indian checklist into line with the *Flora of China* generic treatments for the Acanthaceae (Hu et al., 2011).

The necessary new names and combinations are provided below. I have not always made the appropriate combinations for infraspecific taxa. Many of these are varieties proposed in the 19th century and are probably not worthy of recognition, at least without a detailed study of some of the more widespread weedy species over their whole geographical range, particularly *Justicia pectinata* L.

Haplanthodes

1. Haplanthodes tentaculatus (L.) Nees var. **neilgherryensis** (Wight) J. R. I. Wood, comb. nov. Basionym: *Haplanthus neilgherryensis* Wight, Icon. Pl. Ind. Orient. [Wight] 4(4): 7–8, tab. 1556. 1850. *Haplanthus tentaculatus* (L.) Nees var. *neilgherrensis* (Wight) C. B. Clarke, Fl. Brit. India [J. D. Hooker] 4(11): 507. 1884. *Bremekampia neilgherryensis* (Wight) Sreem., Bull. Bot. Surv. India 6(1–4): 323. 1964 [1965]. *Haplanthodes neilgherryensis* (Wight) R. B. Majumdar, Bull. Bot. Soc. Bengal 25(1–2): 76. 1971. TYPE: [India.] "Neilgherries and Coorg Jungles, Monro, Jerdon"; [*R.*] *Wight s.n.* (lectotype, designated here, K [barcode] K000885689 [sheet with single plant with rootstock]).

Although Wight described this variety as a distinct species and it was so treated by Gamble (1925) and Majumdar (1971), I believe Clarke was correct in treating it as a variety. It is distinguished from *Haplanthodes tentaculatus* var. *tentaculatus* by the congested spikes and pilose sepals and extreme forms of the two varieties look quite distinct. However, at Kew there are many specimens that are intermediate between the two extremes and varietal status seems appropriate. The variety *neilgherrensis* is by no means restricted to the Nilgiri Hills. Varietal status also results in a balanced treatment of infraspecific variation in *H. tentaculus* with the type variety, as well as variety *neilgherrensis* and variety *plumosa* (T. Anderson) Panigrahi & G. C. Das being accorded equal rank.

There were three syntypes collected by Wight and present at Kew, and all represent variety *neilgherryensis*. I have selected the specimen with barcode K000885689 as the lectotype as it the most complete of the three, having rootstock, capsules, and (poor condition) corollas. It is the only sheet on which the location, Coorg, is written.

Justicia

2. Justicia apiculata (Bedd.) J. R. I. Wood, comb. nov. Basionym: *Rungia apiculata* Bedd., Icon. Pl. Ind. Or. 60, tab. 247. 1868–1874. TYPE: India. Tinnevelly Hills, 2–3000 ft., beds of rivers, s.d., *R. H. Beddome 93* (lectotype, designated here, K [barcode] K 000884080).

Rungia apiculata var. *compta* C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(12): 549. 1885, syn. nov. TYPE: India. S. Travancore, s.d., *R. H. Beddome 479* (holotype, BM).

Beddome cited no types for *Rungia apiculata*, and the only possible collection found in the herbaria at BM and K that could be selected as lectotype is *Beddome 93* at Kew. This carries the annotation in ink "Rec[eive]d Major Beddome 5/69" and in pencil "93 aff. R. pectinata, [on the next line] Rungia apiculata Bedd [and below] Tinevelly hills 4000 ft."

3. Justicia concinna J. R. I. Wood, nom. nov. Replaced name: *Rungia elegans* Dalzell in Dalzell & Gibson, Bombay Fl. 196. 1861, non *Justicia elegans* P. Beauv., Fl. Oware 1: 84, tab. 50. 1806. TYPE: India. "Deccan," s.d., *Stocks*

s.n. (neotype, designated here, K [barcode] K000884068).

No collection is cited and I have seen no collections of this species made by Dalzell or any from Junnar, as mentioned in the protologue. However, there are quite a number of collections of this species at K and BM, and it is clearly important to have a valid name so I have neotypified it with the Stocks collection from the "Deccan" locale cited above. There are three pieces on the sheet, and I consider all three to belong to the same collection and to constitute the neotype. This specimen was originally named *Rungia repens* Nees, but had been re-identified by C. B. Clarke as *R. elegans* Dalzell & A. Gibson and clearly represents what has long been treated as this species. The new epithet *concinna* is chosen because it means elegant, as does the original *elegans*.

4. Justicia crenatifolia J. R. I. Wood, nom. nov. Replaced name: *Rungia crenata* T. Anderson, J. Linn. Soc., Bot. 9: 518. 1867, non *Justicia crenata* Pohl ex Nees, Prodr. [A. P. de Candolle] 11: 419. 1847. TYPE: India. "In montibus Canara," s.d., *Law s.n.* (holotype, CAL [barcode] 0000020293).

There is only a single collection by Law from the Canara Mountains at CAL annotated by Anderson, and this should be accepted as the holotype of *Rungia crenata*, Anderson presumably finding this specimen among "the exceedingly rich" holdings of the "herbarium of the Calcutta Botanical Gardens" after leaving Kew in 1861 (Anderson, 1867: 425). There is no isotype at K.

5. Justicia eudoxa J. R. I. Wood, nom. nov. Replaced name: *Justicia laeta* C. B. Clarke in Hook. f., Fl. Brit. India [J. D. Hooker] 4(12): 546. 1885, non *Justicia laeta* Mart. ex Nees, Prodr. [A. P. de Candolle] 11: 350. 1847. TYPE: India. May 1882, [*R.*] *Wight s.n.* [tag 42] (holotype, K [barcode] K000884056).

The new epithet *eudoxa*, meaning of good repute, is chosen for its similarity in meaning to the epithet *laeta*, meaning bright or pleasant.

6. Justicia heyneana J. R. I. Wood, nom, nov. Replaced name: *Rungia linifolia* Nees, in Wall., Pl. Asiat. Rar. (Wallich) 3: 110. 1832, non *Justicia linifolia* (Lindau) V. A. W. Graham, Kew Bull. 43(4): 618. 1988. TYPE: India. "Vidi exemplum Herb. Heyneani," 16 Mar. [18]17, [*Wallich Cat. no. 2447*] (lectotype, designated here, K-W; isolectotype, BM).

Rostellularia gracilis Wight, Icon. Pl. Ind. Or. [Beddome] 4: 6. 1850. *Justicia gracilis* (Wight) T. Anderson, J. Linn. Soc., Bot. 9: 512. 1867, non *Justicia gracilis* Lyall ex Nees, Prodr. [A. P. de Candolle] 11: 506. 1847. TYPE: [India.] [*R.*] *Wight s.n.* (holotype, K).

Mascarenhas and Janarthanam (2010) cite *Heyne 2447* at CAL as the holotype of *Rungia linifolia* Nees. This must be an error as there is no evidence Nees ever saw the specimens kept at CAL. I have designated the specimen in the Wallich herbarium (K-W) as the lectotype as this is more likely to be the material Nees saw. It consists of three pieces, all of which constitute part of the lectotype. There is no annotation by Nees on the sheet, but this is not significant. Only occasional sheets in the Wallich herbarium actually have his annotation, even though his account of Acanthaceae (Nees, 1832) is explicitly based on Wallich's herbarium.

The epithet of the new name honors Benjamin Heyne (1770–1819) who was superintendent of the Bangalore Gardens in the early 19th century.

6a. Justicia heyneana var. **saldanhae** (Mascar. & Janarth.) J. R. I. Wood, comb. nov. Basionym: *Rungia linifolia* Nees var. *saldanhae* Mascar. & Janarth., Novon 20(2): 182–185, fig. 1. 2010. TYPE: India. Karnataka, Chikmagalur Distr., Kottigehara, 21 Feb. 2006, *M. E. Mascarenhas & M. K. Janarthanam 205* (holotype, CAL; isotypes, BSI, MO).

7. Justicia himalayensis (C. B. Clarke) J. R. I. Wood, comb. nov. *Rungia himalayensis* C. B. Clarke in Hook. f., Fl. Brit. India [J. D. Hooker] 4(12): 548. 1885. TYPE: [India.] "Sikkim, Dikeeling," 3–4000 ft., 22 Oct. 1869, *C. B. Clarke 9747* (lectotype, designated here, K [barcode] K000884066 p.p. [two pieces on left side of sheet above sketch of dissection]).

The protologue cites collections from the Tambur River in East Nepal by J. D. Hooker and by C. B. Clarke from Dikeeling. There are, in fact, two collections made by Clarke (*Clarke 9661*, *9747*) from Dikeeling mounted on the same sheet at Kew. I have chosen the collection on the left of this sheet consisting of two pieces above the sketch of the floral dissection as the lectotype because Clarke must have based his description of the floral details on this rather than either the Hooker collection or the other collection mounted on the same sheet (*Clarke 9661*). The collection *Clarke 9747* is in any case the most complete of the original syntypes.

8. Justicia latior (Nees) J. R. I. Wood, comb nov. Basionym: *Rungia latior* Nees, in Hook., Companion Bot. Mag. 2: 213. 1836. *Rungia longifolia* Nees subsp. *latior* (Nees) L. H. Cramer, Kew Bull. 51: 556. 1996. TYPE: Sri Lanka. s.d., [*G.*] *Walker s.n.* (lectotype, designated by Wood [1994a: 114], E-GL).

8a. Justicia latior (Nees) J. R. I. Wood subsp. **latior.**

8a(i). Justicia latior (Nees) J. R. I. Wood var. **latior.**

Rungia longifolia var. *latifolia* Wight ex C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(12): 547. 1885, syn. nov. TYPE: India. [*R.*] *Wight s.n.* (holotype, K [barcode] K000884052).

8a(ii). Justicia latior var. **anamalayana** (Chandrab. & V. Chandras.) J. R. I. Wood, comb. nov. Basionym: *Rungia latior* Nees var. *anamalayana* Chandrab. & V. Chandras., J. Bombay Nat. Hist. Soc. 84(3): 722. 1987 [1988]. TYPE: India. Tamil Nadu, Coimbatore Distr., Anamalai Hills, s.d., *Chandrabose 65859* (holotype, CAL; isotypes, K, MH).

Justicia latior var. *anamalayana* is relatively distinct, with much narrower, oblanceolate, acute bracteoles 8–9 mm long, but only 2–3 mm wide (not obovate, rounded, 4.5–6 × 3–4 mm, as in the type variety). However, intermediates with *J. latior* var. *latior* do occur. This variety appears to be restricted to the Anamalai Hills from where I have also seen *C. E. C. Fischer 3265* (K).

8b. Justicia latior subsp. **longifolia** (Nees) J. R. I. Wood, comb & stat. nov. Basionym: *Rungia longifolia* Nees in Hook., Companion Bot. Mag. 2: 313. 1836, non *Justicia longifolia* G. Forst., Fl. Ins. Austr. 13. 1786. TYPE: Sri Lanka. s.d., [*G.*] *Walker s.n.* (lectotype, designated by Wood [1994a: 114], E-GL).

It should be noted that because the combination *Justicia longifolia* is blocked by the prior existence of *J. longifolia* G. Forst., the oldest available combination for this species is *J. latior*, and this results in subspecies *latior* becoming the autonymic subspecies. The type of Clarke's *Rungia longifolia* var. *latifolia* (*Wight s.n.*) also corresponds to *J. latior* subsp. *latior*, but as Clarke included material of both subspecies under this varietal name it should not be assumed that material identified by Clarke as variety *latifolia* necessarily belongs to subspecies *latior*.

9. Justicia mastersii (T. Anderson) J. R. I. Wood, comb. nov. Basionym: *Rungia mastersii* T. Anderson, J. Linn. Soc., Bot. 9: 519. 1867. TYPE: India. "In Assam ad ripas fluminis Soonder," s.d., *Masters s.n.* (type, CAL, not seen).

Plants described by Anderson (1867) are sometimes deposited at Kew, but are more commonly found at the Central National Herbarium, Howrah, Kolkata (CAL). As Clarke (1885: 550) did not see this species it must be presumed to be at CAL, where Anderson (1867: 425) specifically mentions having seen Masters' collections. Unfortunately, Anderson's types are not always recognized, and failure to locate the type at CAL does not indicate certainly that it is lost (see Albertson & Wood, 2012, for other examples). Anderson provided a more full description of this species than for any other *Rungia*, and I would be confident that the type will eventually be found at CAL.

10. Justicia meghalayana J. R. I. Wood, nom. nov. Replaced name: *Rungia khasiana* T. Anderson, J. Linn. Soc., Bot. 9: 518. 1867, non *Rungia khasiana* C. B. Clarke, Fl. Brit. India [J. D. Hooker] 4(12): 537. 1885. TYPE: [India.] "In montibus Khasiae," s.d., *Griffith s.n.* (lectotype, designated here, CAL [barcode] 0000020309).

There are no sheets at Kew annotated by Anderson, but at CAL there are two that could be considered for lectotypification. One was undoubtedly collected by Griffith (Kew Distribution no. 6165), but this is labeled *Rungia punduana* by Anderson and so must be rejected as lectotype, even though it is labeled as an isolectotype of *R. khasiana*, apparently an unpublished lectotypification, by Jayasri Battacharya. The other sheet has Anderson's annotation of *R. khasiana*, but no further collection details, and is the only possible sheet that can be designated as lectotype.

The new name refers to the Indian state Meghalaya, in which the Khasi Hills are situated.

11. Justicia vallis-silentiosae J. R. I. Wood, nom. nov. Replaced name: *Rungia sisparensis* T. Anderson, J. Linn. Soc., Bot. 9: 518. 1867, nom. nud. ex C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(12): 546. 1885, non *Justicia sisparensis* Lindau, Nat. Pflanzenfam. [Engler & Prantl] iv, heft 3b: 350. 1895. TYPE: India. Sispara, "In montibus Nilagiri, Feb.," Herb. *R. F. Hohenacker 1436* (lectotype, designated here, K [barcode] K000884205 [label with "*Adhatoda sisparensis*" and manuscript diagnosis in Bentham's hand]).

This species was first identified by Bentham as *Adhatoda sisparensis* based on no. 1436 of "Pl. Indiae or. (M. Nilagiri) Ed. R. F. Hohenacker." The specimen at Kew is annotated by Bentham with a short diagnosis and the name "Adhatoda sisparensis sp. n.," but neither the name nor the description was published. Anderson (1867: 518) cited "*Adhatoda sisparensis* Benth. in Scheda Hohenacker, Plant. Ind. Or. n. 1436" in synonymy under his *Rungia sisparensis*, basing his combination on Bentham's name. However, this too was a nomen nudum as no description was included. *Rungia sisparensis* was eventually validated with a description in the *Flora of British India* (Clarke, 1885: 546). Clarke cited various collections from Sispara, Valla Caudo, and Wynard by different collectors besides referring to Bentham in "Pl. Hohenack. n. 136," which he annotated with the name *R. sisparensis*. As the epithet "sisparensis" goes back to Bentham's annotation on *Hohenacker 1436* (K) in his own herbarium, and since the sheet is clearly identified as this species by Clarke, I have designated it as lectotype of *R. sisparensis*.

The new name refers to the Silent Valley National Park in Kerala where the Sispara Peak is situated.

12. Justicia wightiana (Nees) J. R. I. Wood, comb. nov. Basionym: *Rungia wightiana* Nees in Wall., Pl. Asiat. Rar. [Wallich] 3: 110. 1832. TYPE: India. Courtallam, "Vidi exemplum Herb. Wightiani," s.d., [*R.*] *Wight s.n.* [Wallich Cat. n. 2472]. (lectotype, designated here, K-W [barcode] K000014470).

Rungia arnottiana Wight, Icon. Pl. Ind. Or. [Beddome] 4: 6. 1850. TYPE: India. Courtallam, 1836, *R. Wight 794* (holotype, K [barcode] K000884197; isotype, E).

I have selected the Wight collection (no. 2472 in the Wallich herbarium) as lectotype as it is probably this specimen that Nees saw when preparing the protologue, although the sheet bears no annotation by him. It consists of two pieces, which together constitute the lectotype. Isolectotypes are probably present in a number of herbaria including CAL.

STROBILANTHES

13. Strobilanthes alternata (Burm. f.) E. Moylan ex J. R. I. Wood, comb nov. Basionym: *Ruellia alternata* Burm. fil., Fl. Indica 135. 1768. *Hemigraphis alternata* (Burm. f.) T. Anderson, J. Linn. Soc., Bot. 7: 114. 1864. TYPE: [Indonesia.] "Habitat in Java," *s. coll.* (lectotype, designated here, G [barcode] G00380813).

Ruellia colorata Blume, Bijdr. 3: 795. 1826. *Hemigraphis colorata* (Blume) Hallier f., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 70(3): 199. 1897. TYPE: [Indonesia.] Java, s.d., *H. Zollinger 544* (types, B, G-BOISS, G-DC).

Burman cited Herbarium amboinense [Rumphius] 6: 31, tab. 13, figs. 2 and 3, Hortus Indicus Malabaricus [Rheede] 9: 115, tab. 59, and a collection from "Dinding Ary" in Java in the protologue to *Ruellia alternata*. Bremekamp (1944: 126) excluded both illustrations as possible types, and I agree that the Rheede illustration should be excluded as a lectotype as it appears to be a different species, possibly a Scrophulariaceae. I believe that the Rumphius illustration does indeed represent *R. alternata*, but as this was questioned by Bremekamp (1942: 239) a lectotype is best selected from the specimens in Burman's herbarium at Geneva. There are five specimens at G that appear to be syntypes. Two of these are sterile and should be excluded from consideration, and a third is not annotated with the name *R. alternata*. Of the remaining two, the sheet with barcode G00380813 is much the best specimen with a well-developed inflorescence. It is noted as "ex Java 1758" and has been annotated with Linnaeus's description of *Scutellaria indica*. It is one of the specimens separated out by Hochreutiner in 1928 to which Bremekamp referred (1942: 239; 1944: 127).

Strobilanthes alternata is widely cultivated and sometimes naturalized throughout the tropics and in conservatories in temperate countries, although its exact origin is unknown. The new combination was originally proposed by Elizabeth Moylan in her unpublished doctoral thesis at Oxford University in 2003.

Three duplicates of *Zollinger 544*, the type of *Ruellia colorata* Blume, are known, but neither I nor Elizabeth Moylan (Moylan et al., 2002: 807) has been able to find a specimen in the Leiden herbarium (L), where a holotype might be expected, Blume's specimens generally being deposited in this herbarium.

14. Strobilanthes brunelloides (Lam.) J. R. I. Wood, comb. nov. Basionym: *Justicia brunelloides* Lam., Tabl. Encycl. 1: 40–41. [3 Mar.] 1791. *Hemigraphis brunelloides* (Lam.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 90. 1944. *Hemigraphis brunelloides* var. *vahliana* Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 91. 1944, nom. illeg. [superfluous name for the autonymic variety]. TYPE: Indonesia. "L'Isle de Java," s.d., *P. Commerson s.n.* (holotype, P n.v.; isotypes, C [barcodes] C1004866, C1004867).

Justicia hirsuta Vahl, Symb. Bot. 2: 3. [July–Dec.] 1791, nom. illeg., non *Justicia hirsuta* Jacq., Select. Stirp. Amer. Hist., 4. 1763. TYPE: Indonesia, Java, s.d., *P. Commerson s.n.* (holotype, C).

Ruellia venosa Blume, Bijdr. Fl. Ned. Ind. 14. 795. 1826. TYPE: Indonesia. Java, s.d., *C. L. Blume s.n.* (holotype, L n.v.).

Ruellia confinis var. α [*confinis*] Nees in DC., Prodr. 9: 148. 1847. TYPE: Malaysia. "Ins Batu Cawanes, insulae Pulo Pinang," *s. coll.* (lectotype, designated here, G-DC [barcode] 00450426).

Ruellia confinis var. β [*obtusifolia*] Nees in DC., Prodr. 9: 148. 1847. *Hemigraphis confinis* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 463. 1867. TYPE: Malaysia. Malacca, s.d., *Griffith s.n.* (lectotype, designated here, K sheet ex Herb. Hooker [annotated as "Ruellia confinis β obtusifolia N ab E" by Nees]).

Ruellia griffithiana Nees in DC., Prodr. 11: 149. 1847. *Hemigraphis griffithiana* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 463. 1867. TYPE: Myanmar [Burma]. Mergui, s.d., [*W.*] *Griffith s.n.* [Herb. Hooker Kew Dist. 6091] (holotype, K [sheet annotated *Ruellia griffithiana* N. ab E. in Nees's hand]).

Hemigraphis platycarpos C. B. Clarke, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74: 653. 1908, syn. nov. TYPE: Malaysia. Pahang, May 1890, *H. N. Ridley 1408* (lectotype, designated here, BM).

Hemigraphis brunelloides (Lam.) Bremek. var. *subglabra* Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 92. 1944. TYPE: s. loc., possible collector Reinwardt (holotype, L, accession no. H. L. B. 897.278.242 n.v.).

Hemigraphis brunelloides (Lam.) Bremek. var. *angustifolia* Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 92. 1944. TYPE: [Indonesia. Kalimantan,] South-east Borneo, Hayoop, *Winkler 2237* (holotype, L; isotype, B n.v.).

In the protologue for *Ruellia confinis* var. α [*confinis*], Nees (1847: 148–149) cited a Malaysian collection from Penang in de Candolle's herbarium received from Delessert's herbarium and a bibliographic reference with interrogation to *R. venosa* Blume. Because the only definite reference is to the specimen in de Candolle's herbarium, this G-DC sheet has been designated as lectotype of this variety. Nees cited *Cuming 2354* and *Griffith s.n.* as types of *R. confinis* var. β. There are specimens of both collections at K annotated by Nees as *R. confinis* var. *obtusifolia* that must correspond to variety β, which is characterized as with "foliis obtusis" (Nees, 1847: 149). I have selected the Griffith collection originally in Hooker's herbarium as the lectotype as it is a more complete specimen. For unknown reasons Nees never took up the epithet "obtusifolia."

The holotype of *Ruellia griffithiana* at K consists of four pieces on a single sheet. It has the location Mergui and Nees's annotation gummed to the sheet. It was distributed by Kew as no. 6091 of the "Herbarium of the late East India Company," but it is important to note that a Helfer collection from Tenasserim was also distributed under the same number. The Helfer collection is not an isotype. *Ridley 1408* (BM) is designated as the lectotype of *Hemigraphis platycarpos* above. There is no isolectotype at Kew, but there may be one to be found at CAL or SING. The BM lectotype for *H. platycarpos* was not annotated by Clarke but was the only material he was likely to have seen.

Strobilanthes brunelloides is a very variable species, particularly in leaf shape, with two varieties recognized by Nees (1847) under *Ruellia confinis*, and two others by Bremekamp (1944) under *Hemigraphis brunelloides*. An extensive synonomy of this species in Southeast Asia was provided by Bremekamp (1944: 90–93), in which discussion of the variation was provided.

This species is included in the *Flora of British India* (Clarke, 1884: 425) but has never been found within the boundaries of modern India.

15. Strobilanthes carinei J. R. I. Wood, nom. nov. Replaced name: *Stenosiphonium setosum* T. Anderson, J. Linn. Soc., Bot. 9: 464. 1867, non *Strobilanthes setosa* J. R. I. Wood, Edinburgh J. Bot. 51(2): 259. 1994. TYPE: India. *G. Thomson Strobilanthes no. 67* (lectotype, designated by Carine & Scotland [2000: 119], K [barcode] K000882750; isolectotype, K [barcode] K000882749).

Stenosiphonium parviflorum T. Anderson, J. Linn. Soc. Bot. 9: 464. 1867, non *Strobilanthes parviflora* Bedd., Icon. Pl. Ind. Or., 45. 1868–1874. TYPE: [India.] *G. Thomson Strobilanthes no. 68* (lectotype, designated by Carine & Scotland [2000: 119], CAL; isolectotypes, K [barcodes] K000882747, K000882748).

The new epithet *carinei* required for the transfer of *Stenosiphonium setosum* to *Strobilanthes* is chosen for Mark Carine of the Natural History Museum, London, who revised the species previously placed in *Stenosiphonium* (Carine & Scotland, 2000) as part of his doctoral thesis at the University of Oxford.

16. Strobilanthes cordifolia (Vahl) J. R. I. Wood, comb nov. Basionym: *Ruellia cordifolia* Vahl, Symb. Bot. 3: 84. 1794. *Stenosiphonium cordifolium* (Vahl) Alston in H. Trimen, Handb. Fl. Ceylon 6: 226. 1931. TYPE: India. Tranquebar, s.d., *Rottler s.n.* [ex Herb. Vahl] (holotype, C [barcode] C10005185).

Stenosiphonium russellianum Nees in Wallich, Pl. Asiat. Rar. 3: 84. 1832. TYPE: *Russell s.n.* [Herb. Wallich no. 2400] (lectotype, designated by Carine & Scotland [2000: 116], K-W).

Stenosiphonium subsericeum Nees in Wallich, Pl. Asiat. Rar. 3: 84. 1832. *Stenosiphonium russellianum* var. *subsericeum* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 464. 1867. *Stenosiphonium cordifolium* var. *subser-*

iceum (Nees) L. H. Cramer in M. D. Dassanayake & W. D. Clayton, Revised Handb. Fl. Ceylon 12: 76. 1998. TYPE: *Heyne s.n.* p.p. [Herb. Wallich no. 2408a] (lectotype, designated here, K-W [two pieces labeled "b" by C. B. Clarke on right side of sheet]).

Stenosiphonium confertum Nees in DC., Prodr. 9: 105. 1847. TYPE: India. Bouton, s.d., *Belanger 32* (lectotype, designated here, G-DC [barcode] G00461626).

Nees cited four collections in his treatment of *Stenosiphonium subsericeum*. Wallich lists nos. 2416, 2408a (ex parte), 2408b (ex parte), and Wight Herb. Propr. no. 26. Carine and Scotland (2000: 117) state that Cramer (1998) lectotypified this species with a specimen in K-W (Wallich list no. 24086 [sic]). They correctly point out that this number does not exist and speculate, probably correctly, that this is a typographic error for no. 2408b. They cite this as the lectotype of *S. subsericeum*, changing the citation to "*Heyne s.n.*, Wall. Cat. 2408a: specimen labelled 'b' by C. B. Clarke" (Carine & Scotland, 2000: 116). However, examination of the reference in the *Revised Handbook of the Flora of Ceylon* (Cramer, 1998: 76) shows that Cramer did not intend or specify this lectotypification, and, as Carine and Scotland only claim to be identifying the material to which Cramer referred, it seems likely that effective lectotypification was never made. In order to avoid uncertainty I am formally designating the two pieces labeled "b" by C. B. Clarke (on right side of sheet) of Wallich no. 2408a in K-W as lectotype. By doing this I am excluding the two leaves, the small flowering shoot, and the large piece designated "a" in the center of the sheet from the lectotype. There is evidence that Nees actually saw this sheet because a note in his handwriting about a leaf is gummed to the sheet on the left. Such annotations by Nees on the sheets in the East India Company Herbarium (Wallich collection) were quite rare.

Nees cited two collections as types of *Stenosiphonium confertum*, *Belanger 32* in G-DC from Bouton and *Wight s.n.* from Coutallam in Herb. Wight and Wallich. No specimen annotated by Nees with the name *S. confertum* has been found at K, K-W, or E, and as *Belanger 32* at G is annotated "Stenosiphonium confertum N. ab E." in Nees's handwriting, this is accordingly selected as lectotype, being the only original material certainly seen by Nees. The locality "Bouton" has never been identified, but must be in South India, unless given in error for the island in Indonesia off the coast of Sulawesi with this name.

17. Strobilanthes crossandra (Steud.) J. R. I. Wood, comb. nov. *Ruellia crossandra* Steud., Nomencl. Bot. ed. 2, 2: 481. 1841, nom. nov. Replaced name: *Ruellia diffusa* Nees in Wallich, Pl. Asiat. Rar. 3: 83. 1832, non *Ruellia diffusa* Vell., Fl. Flumin. 266. 1825 [1829]. *Hemigraphis crossandra* (Steud.) Bremek. Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41: 137. 1944. TYPE: [India. Uttar Pradesh,] [*Buchanan-*]*Hamilton s.n.*, "Crossandra ?diffusa, Chunar," 1 May 1813 [Herb. Wallich no. 2383a] (lectotype, designated here, K-W).

Ruellia crenata Benth. ex Hohen., Flora 32: 558. 1849. *Hemigraphis elegans* var. *crenata* (Benth.) C. B. Clarke, in Hook. f., Fl. Brit. India 4(11): 425. 1884. *Hemigraphis crenata* (Benth.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 137. 1944. TYPE: India. "Habitat pr. Malasamudra, March," [*R. F.*] *Hohenacker 737* (holotype, K [barcode] K000882590, ex Herb. Benth.; isotype, BM).

Strobilanthes burmanica Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 92. 1873. TYPE: Myanmar [Burma]. Pegu, [*W. S.*] *Kurz 2125* (lectotype, designated here, K [sheet labeled Flora of British Birma, "Recd 15/8/72," with manuscript name in Kurz's handwriting "Strobilanthes birmanica [sic] Kurz" and below "Hemigr Ruellia [crossed out] pavala of TAnd[sic]. Nov[?] spec. Birmania"].

Nees (1832: 83) cited three collections as "Wall. Cat. n. 2383 a, b, c" as syntypes of *Ruellia diffusa*. I have designated the collection listed as Wallich no. 2383a and attributed to the collector Hamilton (s.n.), as the lectotype. Capsules on this sheet are clearly 8-seeded, the character distinguishing this species from *Strobilanthes pavala*. The lectotype was collected at Chunar in what is now Uttar Pradesh.

Kurz cited the three localities of Ava, Prome, and Pegu at the end of the protologue of *Strobilanthes burmanica*. I have selected the only specimen on which his species was unequivocally based as lectotype of *S. burmanica*. There are three other collections at Kew labeled *Kurz 2125*, all from Pegu, but none of these is annotated with the name of the genus in which Kurz described this species; two of the sheets are labeled "Hemigraphis birmanica Kurz," probably by Kurz, and the third "Hemigraphis" in another hand. While the plants represent the same species and have the same number, the labels and annotations are different, and it is not clear if they are duplicates of the same collection or represent different collections of a single species.

Strobilanthes crossandra seems closely related to and may be merely a form of *S. pavala*, but fruiting specimens can be readily distinguished by the 8-seeded capsule (vs. six seeds per capsule in *S. pavala*). As noted by Clarke (1884: 425), some material from Myanmar has a slightly different appearance with more strongly pilose stems than in Indian examples of this species. This might be worthy

of taxonomic recognition when populations in Myanmar can be evaluated more thoroughly. *Strobilanthes crossandra* is apparently uncommon in India, but may largely replace *S. pavala* in Myanmar.

18. Strobilanthes pavala (Roxb.) J. R. I. Wood, comb. nov. Basionym: *Ruellia pavala* Roxb., Fl. Ind. [Roxburgh], ed. 2, fasc. 3: 47. 1832. *Hemigraphis pavala* (Roxb.) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 39(2): 78. 1870. TYPE: India. Pavala, s.d., *Teling s.n.* (lectotype, designated here, Icon. 327 [K] accompanying Roxburgh [1832]).

Ruellia latebrosa Heyne ex Roth, Nov. Pl. Sp. 307. 1821, non *Strobilanthes latebrosa* Ridley, J. Straits Branch Roy. Asiat. Soc. 86: 304. 1922. *Hemigraphis latebrosa* (Heyne ex Roth) Nees, Prodr. [A. P. de Candolle] 11: 723. 1847. *Hemigraphis latebrosa* var. *heyneana* Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 41(1): 139. 1944, nom. illeg. [superfluous name for the autonymic variety]. TYPE: India [or Pakistan]. Islamnagar, 26 Dec. 1811, [*Buchanan-*]*Hamilton s.n.* [Wallich Cat. no. 2395a] (neotype, designated here, K-W p.p. [plant at bottom of sheet]).

Ruellia elegans Hook., Curtis's Bot. Mag., 62 [new series vol. 9]: tab. 3389, 1835, syn. nov. *Hemigraphis elegans* (Hook.) Nees in DC. Prodr. [A. P. de Candolle] 11: 722. TYPE: [India.] Plant cultivated at Glasgow from the "East Indies," (lectotype, designated here, K p.p. [specimen ex Herb. Hooker labeled on left side of sheet "Ruellia Bot Mag. Hort Gl. Ex Ind. Or." and below "Ruellia diffusa N ab E" in Nees's hand, crossed out and then in another hand, "Hemigraphis elegans Nees"]).

Ruellia satpoorensis Wawra, Oesterr. Bot. Z. 31: 281. 1881, syn. nov. TYPE: India. Satpoora, s.d., *Wawra I/1450* (holotype, W n.v.).

Hemigraphis latebrosa var. *beddomei* C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(11): 424. 1884, syn. nov. TYPE: India. Bellary, s.d., [*R. H.*] *Beddome 5780* (holotype, K [barcode] K000882594).

Hemigraphis latebrosa var. *incana* Gamble, Fl. Madras 2: 1019. 1921, syn. nov. TYPE: India. s.d., *Herb. Wight 2272* [distributed at the Royal Gardens, Kew, 1866–1867], (holotype, K [barcode] K000882593).

Ruellia ebracteata Dalzell, Hooker's J. Bot. Kew Gard. Misc. 2: 342. 1850, as *ebracteata*, syn. nov. *Hemigraphis ebracteata* (Dalzell) C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(11): 424. 1884, as *ebracteolata*. *Hemigraphis latebrosa* var. *ebracteata* (Dalzell) Cooke, Fl. Bombay 2: 353. 1905, as *ebracteolata*. TYPE: India. "Crescit raro in Concano septentrionale," s.d., *Herb. Dalzell s.n.* (lectotype, designated here, K [sheet with label "Bombay Herbarium of the late N. A. DALZELL").

Hemigraphis rupestris T. Anderson, J. Linn. Soc., Bot. 9: 462. 1867, nom. illeg. superfl. TYPE: India. [Based on the type of *Ruellia ebracteata* Dalzell.]

Hemigraphis latebrosa var. *rupestris* C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(11): 424. 1884. TYPE: India. 27 Sep. 1798, Heyne in [J. P.] *Rottler s.n.* (lectotype, designated here, K [fertile piece lowermost on sheet at right]).

There are no known type specimens for Roxburgh's *Ruellia pavala*. The protologue (Roxburgh, 1832: 47) notes simply "*Teling*. Pavala," *Teling* being italicized and presumably referring to the collector. I have not been able to locate any collections by Roxburgh or Teling of this species, but because Icon. 327, which accompanies *Flora Indica* (1832), is an excellent diagnostic plate, I have chosen this as lectotype. It should be noted that this plate was not published in *Flora Indica* but is held at Kew and can be viewed at <http://apps.kew.org/floraindica/home.do> (Royal Botanical Gardens, Kew, 2006).

The type of *Ruellia latebrosa* was a Heyne collection ("sub nomine *Ruelliae latebrosae* et *rupestris* specimina accepi a Veneratiss. Benj. Heyne ex India orientali." [Roth, 1821: 307]) probably destroyed in Berlin in 1943, and there is no isotype at Kew. None is known elsewhere, so I have selected as neotype the specimen [*Buchanan-*]*Hamilton s.n.* [Wallich no. 2395a] in the Wallich (East India Company) herbarium at Kew, specifically the piece in the bottom half of the sheet annotated by C. B. Clarke as "Hemigraphis latebrosa Nees C. B. Clarke (Pavala Roxb. Type)." The neotype was collected at Islamnagar, but the location is uncertain as this name refers to several places including villages near Karachi and Lahore in present-day Pakistan, one near Bhopal in Madhya Pradesh, and another in Badaun District of Uttar Pradesh in northern India. This last locality seems the most likely site of Hamilton's collection in 1811.

Bremekamp (1944) regularly provided names for autonymic varieties, and *Ruellia latebrosa* var. *heyneana* is one such instance.

The next oldest name in the synonymy of *Strobilanthes pavala* is *Ruellia elegans*, which was accompanied by an illustration in *Curtis's Botanical Magazine*, the painting having been made from a plant cultivated in Glasgow grown from seed from the "East Indies" (Hooker, 1835), according to the unnumbered pages of the narrative that follows Plate 3389. The type is in Hooker's herbarium at Kew, the specimen bearing a strong resemblance to the illustration. The shape of the corolla, its blue limb, the leaf shape, and the hirsute longer anthers fit *S. pavala* well. There are only very immature capsules on the selected lectotype, and none are evident on the painting. The material must have originated from India rather than from the East Indies. Later authors, including Nees (1847) and Clarke (1884), created confusion by including other taxonomic elements under the name *R. elegans*.

The original label of the type of *Hemigraphis latebrosa* var. *beddomei* has written on it in a different hand the words "Acanthaceae," "16," and "Ramandroog." The number 16 is not a collection number. Ramandroog was a hill station, military cemetery, and sanatorium in Bellary District, Karnataka State, in India. It may be the precise spot where the type was collected, but this is speculation.

There are two sheets of *Ruellia ebracteata* at Kew which might be considered for lectotypification. One comes from Hooker's herbarium and has the label "Ruellia ebracteolata" in what I take to be Dalzell's hand, indicating, in my opinion, that Dalzell himself had come to realize that his epithet "ebracteata" should have been "ebracteolata." The other sheet is labeled as belonging to the "Bombay herbarium of the late N. A. Dalzell. Presented by Mrs Dalzell, April 1878" with a second label "Bundle marked R. ebracteolata Dalz." Attached to the sheet in the bottom right corner is a larger label in pencil in Dalzell's hand saying "Ruellia latebrosa ? differs in some slight degree from the descr. of that plant, but is the only Ruellia in my possession." Below this, "Dalzell" is written in ink. The epithet of Dalzell's *R. ebracteata* was altered on both sheets to "*ebracteolata*," and this name change was followed by Anderson (1867: 462) and by Clarke (1884: 424), as the plant lacks bracteoles, not bracts. However, as there is no clear evidence that "*bracteata*" was a typographic error, this epithet has to be used in preference to "*ebracteolata*." I have designated the specimen with the Bombay herbarium label as the lectotype as this is the only sheet certainly used by Dalzell in preparing the protologue. The specimen consists of 10 pieces and a leaf.

In the case of *Hemigraphis rupestris*, Anderson (1867: 462) cited "Ruellia rupestris et R. ebracteolata" in synonomy but provided no description. The first name mentioned by Anderson is an unreferenced nomen nudum and the second a variant spelling of the earlier valid name *Ruellia ebracteata*. Anderson's *H. rupestris* is, therefore, superfluous as it can only be based on the earlier, validly published *R. ebracteata*, even if he intended to include other elements, such as collections by Law and Stocks. Anderson apparently never saw authentic material of *R. ebracteata*, something confirmed both by the absence of an exclamation mark after his citation of Dalzell (Anderson, 1867: 462 infra) and by the absence of any annotation by Anderson on the original syntypes of *R. ebracteata* at Kew.

In describing variety *rupestris* of *Hemigraphis latebrosa*, Clarke (1884: 424) noted the problems in the typification of *H. rupestris* T. Anderson and referred to the "authentic sheet" named by Heyne in Rottler's herbarium at Kew. This sheet is a mixed collection; Clarke expressly excluded the parts he identified as *Lepidagathis fasciculata* Nees, a species commonly growing with and confused with *Strobilanthes pavala* (Clarke, 1885: 522). The lectotypification made above includes only the single fertile piece in the bottom right-hand corner of the sheet and excludes the other three pieces that belong to the material identified by Clarke as *Lepidagathis fasciculata*. The two barcodes stuck to the sheet at Kew are ambiguously placed, and it is not certain whether either refers unequivocally to the lectotype, so neither has been cited. It should be noted that some specimens assigned by Clarke to variety *rupestris* are much more scabrid-hirsute than the lectotype.

The name *Hemigraphis flaccida* (Kurz) C. B. Clarke should probably be included in the above synonomy, but I hesitate to make a formal decision without access to more material from Myanmar.

The lengthy synonomy cited above and the complicated typifications reflect the fact that *Strobilanthes pavala* is a very variable taxon in its various forms of intergrading indumentum.

19. Strobilanthes sinuata J. R. I. Wood, nom. nov. Replaced name: *Ruellia repanda* L., Sp. Pl., ed. 2, 2: 886. 1763, non *Strobilanthes repanda* (Blume) J. R. Benn., Kew Bull. 58(1): 56. 2003. *Hemigraphis repanda* (L.) Hallier f., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 70: 198. 1897. TYPE: [Indonesia. Cited by Linnaeus as China, but probably Java.] Herb. LINN (lectotype, designated here, LINN 804.12).

In choosing a lectotype for *Ruellia repanda* I have selected the specimen in the Linnean Herbarium over the plate in Rumphius, Herb. Amboin. 6:30, tab. 13, f. 13., as the specimen clearly shows the habit, inflorescence, and characteristic sinuate leaves of this species.

Strobilanthes sinuata is a Javanese species reported as cultivated in India (Karthikeyan et al., 2009). The new epithet *sinuata* refers to the distinctive form of the leaf margins.

20. Strobilanthes urens (Roth) J. R. I. Wood, comb. nov. Basionym: *Ruellia urens* Roth, Nov. Pl. Sp. 302. 1821. *Gantelbua urens* (Roth) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41(1): 147. 1944. *Hemigraphis urens* (Roth) J. R. I. Wood, Edinburgh J. Bot. 51(1): 108. 1994. TYPE: India. "In India orientali legit Benj. Heyne et sub hoc nominee

benevole communicavit" (lectotype, designated here, K [barcode] K000882613).

Ruellia dura Nees in Hook., Companion Bot. Mag. 2: 311. 1836. *Hemigraphis dura* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 461. 1867. TYPE: India. s.d., *J. Campbell s.n.* (lectotype, designated by Wood [1994a: 108], E-GL).

The holotype of *Ruellia urens* was destroyed at B in 1943, and typification of the name is needed. The selected lectotype of *R. urens* at K consists of a single sheet with, at the bottom, the characteristic label of Rottler's herbarium with the name *R. urens*. There are five pieces on the sheet, and I consider these to represent a single collection and constitute the lectotype. There are various annotations on the sheet, a description of the plant in the bottom right-hand corner; the piece on the right toward the bottom of the sheet impaling a label that reads "Ruellia urens 18"; a label on the right side with the words "Ruellia urens Roxb ab amici fo Heyne"; another label on the left side with the name "Ruellia fasciculata," the word "fasciculata" crossed out and replaced with "urens Roxb" and in another hand "ab Heyn Samulcot, Mart 1811" added. These last two annotations strongly suggest this material was sent by Heyne, and it seems likely that it represents a duplicate of the material received by and used by Roth to originally describe *R. urens*.

21. Strobilanthes venosa (Heyne ex C. B. Clarke) J. R. I. Wood, comb. nov. Basionym: *Hemigraphis venosa* Heyne ex C. B. Clarke, in Hook. f., Fl. Brit. India [J. D. Hooker] 4(11): 423. 1884. TYPE: India. "Ruell: venosa Ruellia crisp? Kumulentawanej," 15 Feb. 1796, *Rottler s.n.* (lectotype, designated here, K [barcode] K000882597).

Clarke cited collections by Rottler and Wight, and both syntypes are present at Kew and annotated *Hemigraphis venosa* in Clarke's hand. I have chosen the Rottler specimen as the lectotype, partly because it is the better specimen (there are no open corollas on the Wight specimen) and partly because it is labeled with the name "Ruell venosa" in what I assume to be Rottler's hand, which was the epithet taken up by Clarke. Both pieces mounted on the sheet are apparently the same collection by Rottler and both constitute the lectotype.

Nees (1832: 83; 1847: 146) incorrectly treated the two original syntypes of *Hemigraphis venosa* as belonging to *Ruellia crispa* L., which is *Strobilanthes crispa* (L.) Blume, a species from Java.

22. Strobilanthes wightii (Bremek.) J. R. I. Wood, comb. nov. Basionym: *Stenosiphonium wightii* Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2., 41: 153. 1944. TYPE: India. Courtallam, *R. Wight s.n.* (lectotype, designated by Carine & Scotland [2000: 121], K [barcode] K882746000, portion on right side of sheet, redesignated here; isolectotype, K [barcode] K000882746).

Wight's collection from the Courtallam area in India was described and illustrated under the name *Stenosiphonium diandrum*, a later homonym of *S. diandrum* Nees (1847: 105), a species from Sri Lanka. A Wight collection at Kew consisting of three pieces was designated as the lectotype of *S. wightii* by Carine and Scotland (2000: 121). The annotation is placed on the right side of the sheet at Kew and according to the notes in Mark Carine's unpublished doctoral thesis for the University of Oxford, the lectotype is the piece on the right-hand side of the sheet only because this most closely resembles the illustration in Wight (1850: tab. 1502). The redesignation above expressly limits the lectotype to this flowering piece with barcode K00088274, but the two other shoots on the same sheet belong to the same taxon and apparently to the same collection; I consider them to be isolectotypes. A second barcode, K000882746, is pasted above the shoot on the upper left of the sheet, while at the bottom of the sheet a third shoot, mostly fruiting, is not barcoded. A second sheet at Kew with four pieces mounted on it appears also to be from the same collection. Two barcodes (K000882743 and K000882745) are pasted to this sheet, but it is not clear to which pieces the barcodes refer.

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Ulva shanxiensis (Ulvaceae), a New Species from Shanxi, China

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ABSTRACT. *Ulva shanxiensis* L. Chen, J. Feng & S. L. Xie (Ulvaceae), a new species from Shanxi Province in northern China, is described, illustrated, and compared with its closest relatives. The taxon may be confused with *U. prolifera* O. F. Müller and *U. intestinalis* L., but is characterized by abundant spinal branches that end with a single-tier cell and more than one pyrenoid. A taxonomic key is provided to facilitate the identification of this new species and closely related freshwater species in China. Molecular studies also confirm the position of the new species among other green algal species of the Ulvaceae.

Key words: China, IUCN Red List, Shanxi, *Ulva*, Ulvaceae.

Members of the genus *Ulva* L., s.l., are well known for their cosmopolitan distribution and include species previously described as *Enteromorpha* Link. These green algae (Ulvaceae) can be found growing in marine or brackish waters and even freshwater habitats around the globe (van den Hoek et al., 1995; Li & Bi, 1998). As presently circumscribed, there are more than 90 species accepted taxonomically in the genus *Ulva* (Guiry & Guiry, 2014), with only four freshwater species reported in the only Chinese freshwater green algal flora published up to now (Li & Bi, 1998).

It is extremely difficult to taxonomically discriminate this genus because of its morphological plasticity (Bliding, 1963, 1968; Koeman & van den Hoek, 1985). Considering the difficulties in morphological observation, molecular markers such as *rbcL*, small subunit (SSU), and ITS have been used in systematic analyses of the genus (Blomster et al., 1998; Malta et al., 1999; Woolcott & King, 1999; Blomster et al., 2000; Hayden et al., 2003; Shimada et al., 2003). With the development of molecular markers, new choices for species identification have been proposed by scholars (Famà et al., 2002; Presting, 2006; Sherwood & Presting, 2007). The plastid gene *tuf*A is a viable alternative for phylogenetic studies due to its conserved character among different taxa (Saunders & Kucera, 2010) and could be used as a suitable marker in species identification (Famà et al., 2002; O'Kelly et al., 2004b; Saunders & Kucera, 2010; Wolf et al., 2012).

During field investigation of freshwater environments of Shuozhou City (Shanxi, China), we collected a hollow, tubular green macroalga. It was initially identified as *Ulva* based on its tubular membrane character, but it did not correspond to any published species description (Printz, 1964; Tseng, 1983; Li & Bi, 1998; Hu & Wei, 2006). We carried out phylogenetic analyses based on SSU (rRNA, small subunit) and *tuf*A (plastid DNA) regions to determine the taxonomic position of the alga, which confirm it as another new freshwater species of *Ulva*.

Materials and Methods

Algal thalli were washed thoroughly and repeatedly with sterilized freshwater to remove all the unwanted impurities, adhering sand particles, and epiphytes. Voucher specimens were deposited in the SXU herbarium at Shanxi University. Specimens used for morphological observation were preserved in formalin. The others were frozen at −20°C for molecular study. Morphological characteristics were examined in surface and transverse section views under a light microscope (BX-51; Olympus, Tokyo,

Table 1. GenBank accession numbers for rDNA and cpDNA sequences (SSU and *tuf*A, respectively) for *Ulva* species analyzed in phylogenetic comparison with *U. shaxiensis* L. Chen, J. Feng & S. L. Xie.

Taxon	SSU	*tuf*A	Citation*
Ulva arasakii Chihara		AB561079	Matsumoto et al., 2011
U. australis Areschoug		KC411856	Du et al., 2014
U. beytensis Thivy & Sharma		KC661441	Gupta, Saliya, Reddy & Jha, unpub.
		JF918547	Gupta, Bijo, Reddy & Jha, unpub.
U. californica Wille	AY303586		O'Kelly et al., 2004a
		JN029283	Kirkendale et al., 2013
		HQ610280	Saunders & H. Kucera, 2010
U. compressa L.	AB425967		Ichihara et al., 2009
		KC661426	Gupta, Saliya, Reddy & Jha, unpub.
		HE600185	Wolf et al., 2012
		KF195543	Lawton et al., 2013
U. curvata (Kützing) De Toni	AF189078		Sherwood et al., 2000
U. erecta (Lyngbye) Fries		KC661427	Gupta, Saliya, Reddy & Jha, unpub.
U. fasciata Delile	AB425964		Ichihara et al., 2009
		KC661442	Gupta, Saliya, Reddy & Jha, unpub.
		KC661448	Gupta, Saliya, Reddy & Jha, unpub.
U. flexuosa Wulfen	AB425963		Ichihara et al., 2009
		HQ610296	Saunders & Kucera, 2010
		JN029308	Kirkendale et al., 2013
U. gigantea (Kützing) Bliding		HQ610297	Saunders & Kucera, 2010
U. howensis (A. H. S. Lucas) Kraft		JN029310	Kirkendale et al., 2013
U. intestinalis L. [≡ *Enteromorpha intestinalis*	AF189077		Sherwood et al., 2000
(L.) Nees]	JN093104		Lin et al., 2012
	AB425966		Ichihara et al., 2009
	FR865742		Gachon et al., unpub.
	AJ005413		Tan & Sluiman, unpub.
		AY454399	O'Kelly et al., 2004b
		KC661439	Gupta, Saliya, Reddy & Jha, unpub.
		KF195546	Lawton et al., 2013
U. lactuca L.	AB425960		Ichihara et al., 2009
		KC661443	Gupta, Saliya, Reddy & Jha, unpub.
		HQ610366	Saunders & Kucera, 2010
U. laetevirens Areschoug		JN029324	Kirkendale et al., 2013
		JQ048943	Mao, Yarish, Kim & Wilson, unpub.
U. linza L.	AB425962		Ichihara et al., 2009
	JN093105		Lin et al., 2012
		KC661446	Gupta, Saliya, Reddy & Jha, unpub.
		HQ610368	Saunders & Kucera, 2010
U. lobata (Kützing) Harvey		HQ610377	Saunders & Kucera, 2010
U. ohnoi M. Hiraoka & S. Shimada		KF195533	Lawton et al., 2013
Enteromorpha ovata Thivy & Visalakshmi ex H. Joshi & V. Krishnamurthy		KC661429	Gupta, Saliya, Reddy & Jha, unpub.
U. pertusa Kjellman	HQ850571		Lin et al., 2012
	AB425961		Ichihara et al., 2009
U. procera (K. Ahlner) H. S. Hayden, Blomster, Maggs, P. C. Silva, Stanhope & Waaland		HQ610386	Saunders & Kucera, 2010
		JN029337	Kirkendale et al., 2013
U. prolifera O. F. Müller [≡ *Enteromorpha prolifera* (O. F. Müller) J. Agardh; = *Enteromorpha salina* Kützing]	HQ850569		Lin et al., 2012
		KC661428	Gupta, Saliya, Reddy & Jha, unpub.
		EF595301	Rinkel et al., 2012
		HQ610404	Saunders & Kucera, 2010
		HQ610403	Saunders & Kucera, 2010
U. reticulata Forsskål	AB425965		Ichihara et al., 2009
		KC661444	Gupta, Saliya, Reddy & Jha, unpub.
U. rigida C. Agardh	AJ005414		Tan & Sluiman, unpub.
U. stenophylla Setchell & N. L. Gardner		HQ610435	Saunders & Kucera, 2010

Table 1. Continued.

Taxon	SSU	*tuf*A	Citation*
U. torta (Mertens) Trevisan		HQ610438	Saunders & Kucera, 2010
		JN029341	Kirkendale et al, 2013
Ulvaria obscura (Kützing) P. Gayral ex C. Bliding [≡ *Ulva obscura* Kützing]	AY303590		O'Kelly et al., 2004a
		HQ610405	Saunders & Kucera, 2010
Umbraulva amamiensis (Tanaka) Bae & I. K. Lee [≡ *Ulva amamiensis* Tanaka]	AB426256		Ichihara et al., 2009
Umbraulva japonica (Holmes) Bae & I. K. Lee [≡ *Letterstedtia japonica* Holmes; ≡ *Ulva japonica* (Holmes) Papenfuss]	AB426255		Ichihara et al., 2009
		JN029346	Kirkendale et al., 2013

Japan). Photographs of main characters were taken with a digital camera (CAMEDIA C5060WZ, Olympus) and a CCD camera (DP72, Olympus) mounted on the microscope.

Genomic DNA was extracted from frozen specimens by using either the modified cetyltrimethylammonium bromide (CTAB) method (Doyle & Doyle, 1987) or ColumnMate Tissue/Cell gDNA Isolation Mini Kit (Watson, Shanghai, China), following the manufacturer's instructions. The primers (NS1 and NS8) and polymerase chain reaction (PCR) procedure used to amplify SSU fragments were in accordance with the previous protocol (Sherwood et al., 2000), and the primers tufGF4 and tufAR were used to amplify *tuf*A fragments (Famà et al., 2002). This region was amplified as described in Saunders and Kucera (2010). All PCR reactions were performed on a MyCycler Thermal Cycler (Bio-Rad, Hercules, California, U.S.A). PCR products were purified with the Gel Extraction Mini Kit (Watson) according to the manufacturer's instructions. After being purified, PCR products were sequenced by Takara Biotechnology Company (Dalian, China) and Sangon Biotech Company (Shanghai, China). When PCR products failed in direct sequencing, they were cloned to vector, according to the manufacturer's protocol (pMD™18-T Vector Cloning Kit, Takara) before sequencing. Sequences generated from the research were deposited in GenBank (accessions KJ617035 for SSU, KJ617036 for *tuf*A).

The sequences of the new species were aligned with sequences from previous research for 25 species of both marine and freshwater *Ulva* worldwide (cf. Table 1), using Clustal X 2.0 (Thompson et al., 1997) and MEGA 5.0 (Tamura et al., 2011) at default settings. All ambiguous positions were removed prior to analyses. Also from the Ulvaceae, *Ulvaria obscura* (Kützing) P. Gayral ex C. Bliding, *Umbraulva amamiensis* (Tanaka) Bae & I. K. Lee, and *Umbraulva japonica* (Holmes) Bae & I. K. Lee were used as outgroups in phylogenetic analyses. Nucleotide differences were calculated by using uncorrected p-distances, which were performed by MEGA 5.0 (Tamura et al., 2011). Maximum parsimony (MP) analyses were conducted with PAUP*4.0 software, using heuristic search and tree bisection-reconnection (TBR) branch swapping (Swofford, 1998). Maximum likelihood (ML) analyses were performed using PhyML 3.0 (Guindon & Gascuel, 2003). Best fit models were selected under the Akaike information criterion (AIC) using Modeltest 3.7 (Posada & Crandall, 1998). The best fit model used for each locus is listed in Table 2. The bootstrap resampling method, using 1000 respective replicates, was used for estimating robustness of trees reconstructed by MP and ML analyses (Felsenstein, 1985). Bayesian inferences were performed with MrBayes 3.1.2 (Ronquist & Huelsenbeck, 2003), using the models previously estimated. Two independent runs, each comprising four chains, were completed for 10,000,000 generations and sampling every 100

Table 2. Model selection results for each phylogenetic dataset. Best fit models were selected under the Akaike information criterion (AIC) using Modeltest 3.7 (Posada & Crandall, 1998).

Gene	Base number	Model	Model parameters
SSU	1661	TIM+I	Base = (0.2491, 0.2166, 0.2758) Rmat = (1.0000, 1.3875, 1.6413, 1.6413, 6.2082) Rates = equal Pinvar = 0.8801
*tuf*A	735	GTR+I+G	Base = (0.3594, 0.1324, 0.2012) Rmat = (2.7210, 4.9344, 0.6340, 2.5644 8.8477) Rates = gamma Shape = 0.8032 Pinvar = 0.5612

generations. The inferences were stopped when the average standard deviation of split frequencies was lower than 0.01. The consensus tree was reconstructed after burn-in of 25% generations.

Ulva shanxiensis L. Chen, J. Feng & S. L. Xie, sp. nov. TYPE: China. Shanxi: Shuozhou City, Simabo Village, Shentou Spring, attached at the bottom of a stream, 39°23.129′N, 112°33.818′E, 1056 m, 7 Apr. 2006, *G. Yao & B. Li, SAS06035* (holotype, SXU). Figure 1.

Haec species *Ulva prolifera* O. F. Müller et *U. intestinali* L. affinis, sed a hac thallo spinoso-ramosissimo, ab illa cellulis polygonis usque quadratis, ab ambabus pyrenoidibus una ad quinque in quaque cellula differt.

Thallus light green, tubular, up to 25 mm diam., abundantly spinal branched; branches ca. 40–50 μm diam., each ending in a single-tier cell (Fig. 1E); cells in surface view polygonal to quadrate, ca. 23–30 × 12–20 μm, arrayed in distinctively longitudinal series in younger thalli, gradually becoming less ordered in older ones (Fig. 1F); cells in cross-section of membrane ca. 15–20 × 10–15 μm (Fig. 1C); cells with several pyrenoids ranges from 1 to 5.

Ecology and distribution. *Ulva shanxiensis* was attached at the bottom of a stream in Shentou Spring, Shuozhou City, Shanxi Province, in northern China. The stream is about 3 m wide, 40 cm in depth, and the water is clear, with a temperature of 15°C and pH 6.8 in April.

IUCN Red List category. *Ulva shanxiensis* is known only from Shentou Spring, Shouzhou City, Shanxi. The distributional area is about 6 km² and there are ca. 500 to 700 individuals (D1, D2). This species should be categorized as Vulnerable (VU) according to IUCN criteria (IUCN, 2012).

Etymology. The specific epithet is derived from the spring name of the type locality.

Discussion. Morphological characters for *Ulva shanxiensis* are obviously different from those of *U. intestinalis*, which is the only freshwater *Ulva* species recorded completely in China (Tseng, 1983; Li & Bi, 1998). *Ulva shanxiensis* is characterized by abundant spinal branches in both the new species and *U. prolifera* (vs. simply or rarely branched from the very base in *U. intestinalis*). The sparse branches all over *U. intestinalis* thallus or only at the base of the thallus make it different from *U. shanxiensis*. The cell walls are not thicker on the internal surface of the thallus in transverse section in both the new species and *U. prolifera* (vs. generally thickened internally in *U. intestinalis*). Cells of *U. shanxiensis* are polygonal to quadrate in surface view, ca. 12–20 × 23–30 μm. Cells of *U. prolifera* are often round to polygonal and cells of *U. intestinalis* are polygonally rounded. The cell dimension of *U. shanxiensis* is a little bigger than that of *U. intestinalis* (ca. 10–15 × 13–25 μm) and *U. prolifera* (10–12 × 12–18 μm). The number of pyrenoids is more than one, ranging from one to five in *U. shanxiensi*, but only one pyrenoid is found in cells of both *U. intestinalis* and *U. prolifera*.

We determined and aligned 1661 nucleotides within the rRNA SSU sequences in this study. Twenty-two aligned SSU sequences had 95 (5.72%) variable bases and 42 (2.53%) parsimoniously informative sites. The G+C content was 49.6% in the aligned sequence data set. Within the aligned regions, the average of uncorrected p-distance was 0.011 from the aligned data set. The uncorrected p-distance between ingroup species and outgroup species ranged from 0.012 to 0.028. Six nucleotide differences were found between *Ulva shanxiensis* and *U. pertusa* Kjellm. from Japan with 1653 nucleotide aligned sequences (0.36%); seven nucleotide differences were found between *U. shanxiensis* and *U. lactuca* L. from Japan with 1653 nucleotide base aligned sequences (0.42%). *Ulva shanxiensis* resolved as sister in clade B with *U. pertusa* and *U. lactuca* (Fig. 2, with 0.61 Bayesian posterior probability). The topology of the Bayesian inference (BI) tree and the ML tree were similar, but differed in that *U. pertusa* and *U. lactuca* were sister to *U. shanxiensis* rather than basal sister to the clade including *U. shanxiensis*. Contrary to the ML tree, these three species had the same placement in the MP tree as in the BI tree, but at low support values.

A total of 735 base pairs for *tuf*A sequences were determined and aligned in this study. The aligned 41 *tuf*A sequences had 195 (26.53%) variable bases and 119 (16.19%) parsimoniously informative sites with 33.4% G+C content. The average of uncorrected p-distance was 0.053 from the aligned *tuf*A sequence dataset. The uncorrected p-distance between ingroup and outgroup species ranged from 0.060 to 0.103. Between 29 and 31 nucleotide differences were found between *Ulva shanxiensis* and *U. prolifera* for accessions from the United Kingdom, Canada, and the United States. For 730–732 nucleotide aligned sequences (3.97%–4.23%), 23 nucleotide differences were found between *U. shanxiensis* and *U. gigantea*, and for 730 nucleotide aligned sequences (3.15%). The phylogenetic tree based on *tuf*A gene indicated that *U. shanxiensis* is included in clade B with *U. gigantea*, *U. laetevirens*,

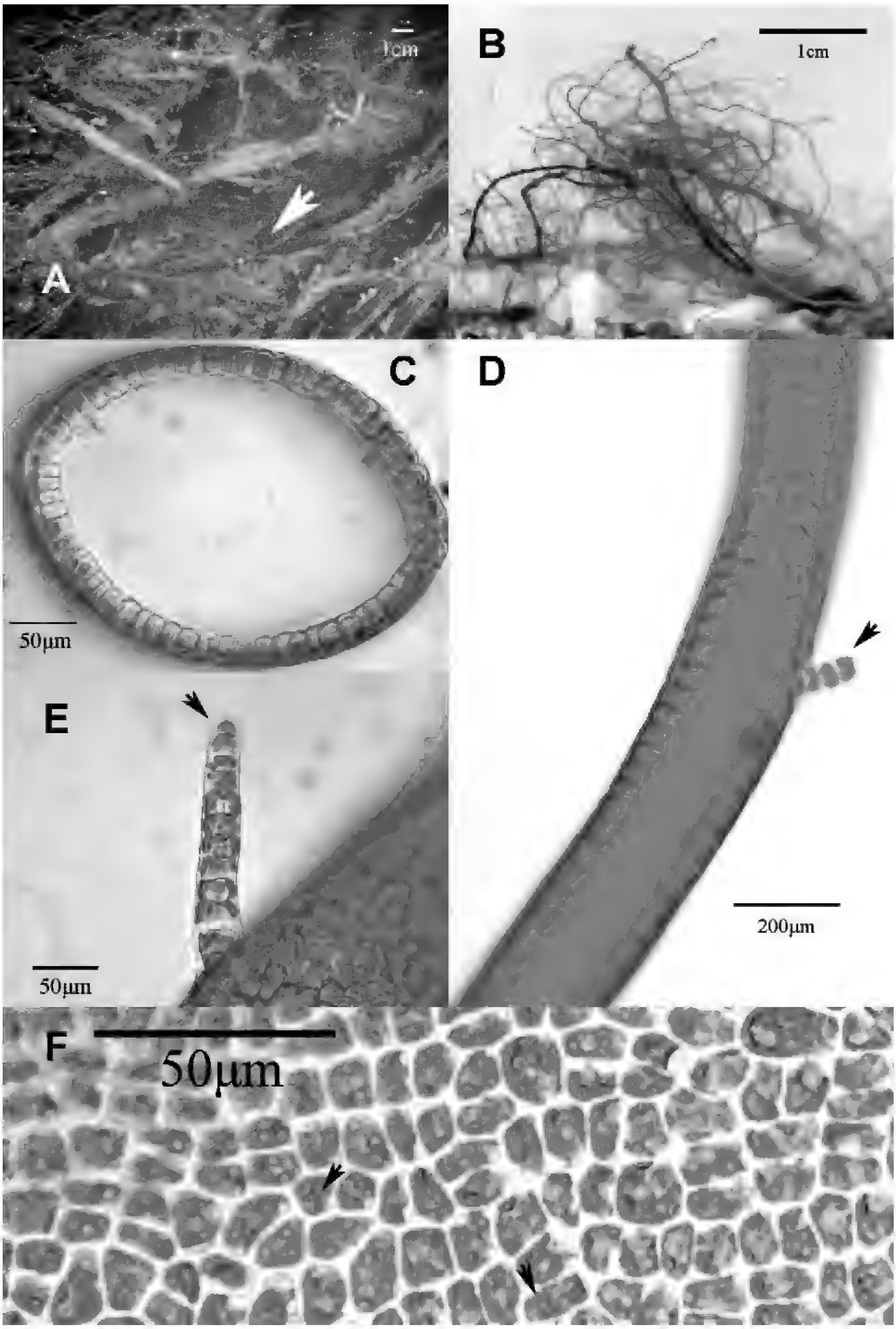


Figure 1. *Ulva shanxiensis* Le Chen, J. Feng & S. L. Xie. —A. Habitat showing attachment of thalli to the bottom of the freshwater spring. Arrow indicates the basal attachment of the tubular thallus. —B. Young thalli. —C. Thallus cross-section, showing the even cell-wall thickness. —D, E. Branches. Arrows indicate uniseriate branches terminating in the single-tiered cell. —F. Thallus surface. Arrows indicate the epidermal cells, with polygonal to quadrate shapes. A, B taken at Shentou Spring by L. Chen.

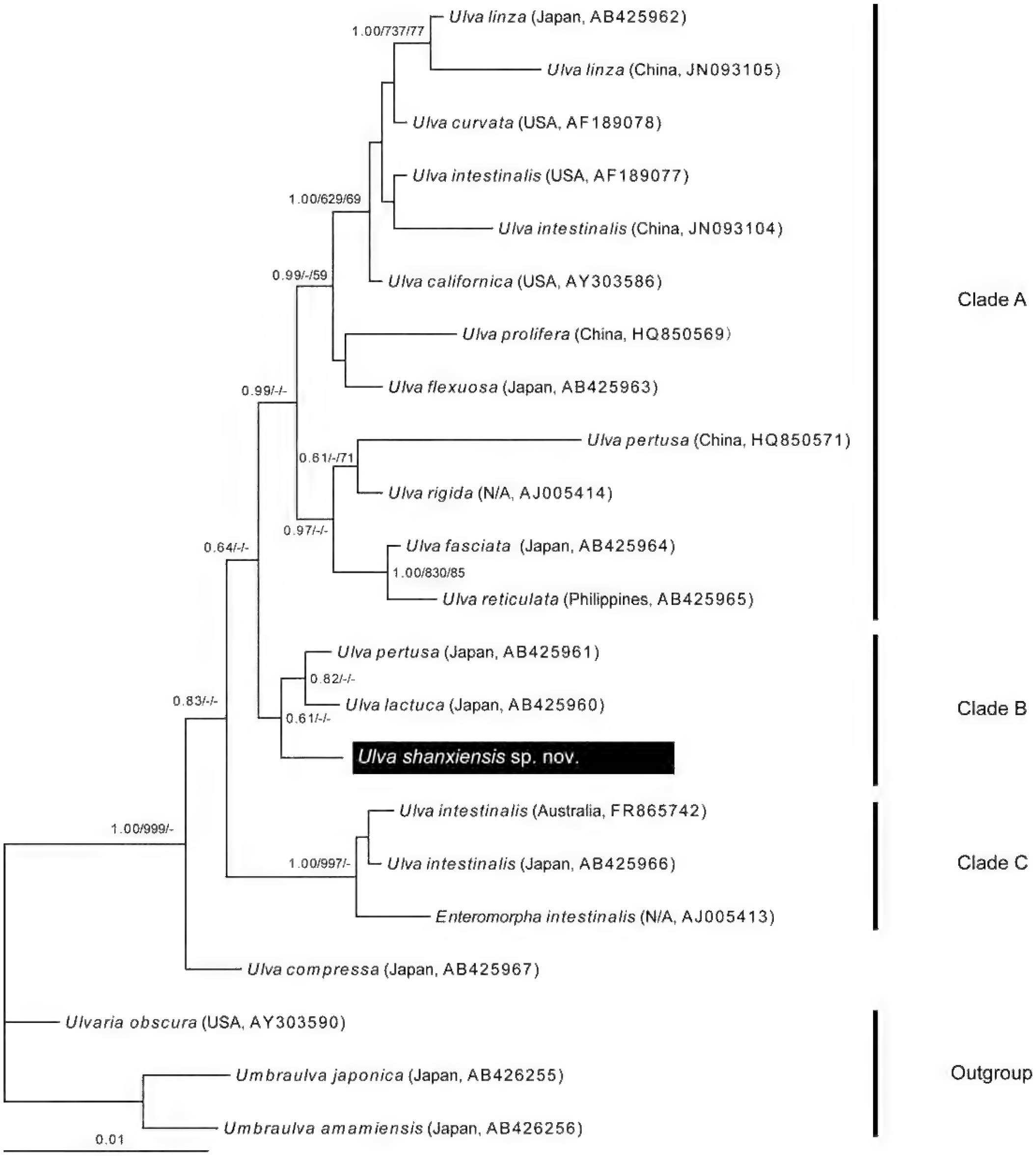


Figure 2. Phylogenetic tree reconstructed using Bayesian inference from the SSU sequence dataset. Numbers at nodes represent Bayesian posterior probabilities/maximum likelihood bootstrap/maximum parsimony bootstrap values. Support values less than 50% are not shown. Scale bar represents 0.01 substitutions per site.

U. fasciata, *U. ohnoi*, *U. beytensis*, *U. reticulate*, and *U. lactuca* (Fig. 3, with 0.88 posterior probability/-/64 MP bootstrap support values). Accessions of *U. shanxiensis* also positioned in clade B in the MP and ML trees, but differed in some detail. The new species is further supported by significant genetic differences found in *tuf*A sequences. *Ulva shanxiensis* shares relationship with morphologically similar *U. intestinalis* and *U. prolifera*, but both species assort differently, to clade C and clade A, respectively (Fig. 3). The new species differed from *U. intestinalis* by nine to 20 and 40 nucleotide substitutions in the SSU and *tuf*A sequences, respectively. Sixteen and 29 to 37 nucleotide substitutions were observed between the new species and *U. prolifera* in the SSU and *tuf*A sequences, respectively. *Ulva shanxiensis* differed by 23 nucleotide substitutions in the *tuf*A sequences

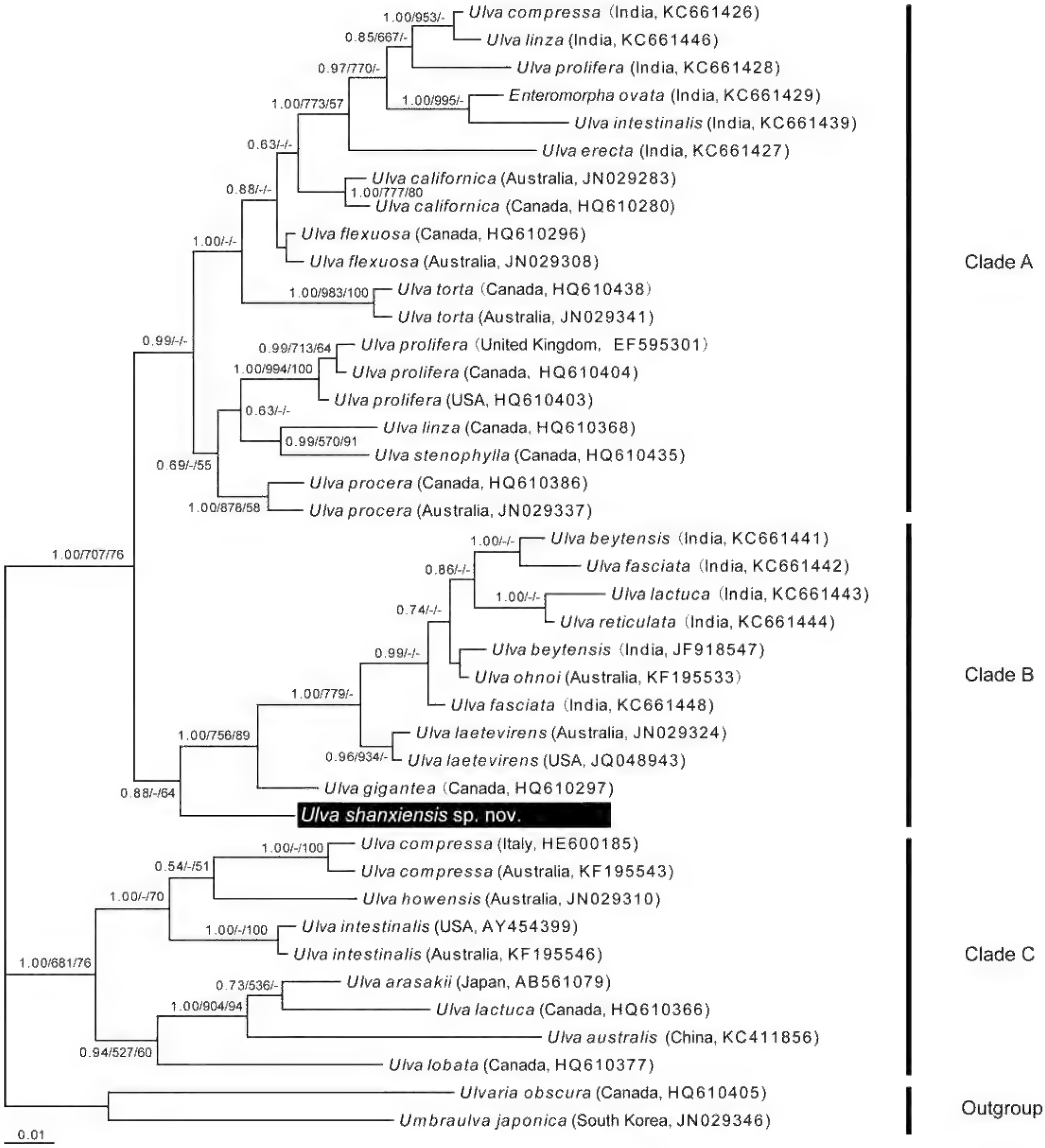


Figure 3. Phylogenetic tree reconstructed using Bayesian inference from the *tuf*A sequence dataset. Numbers at nodes represent Bayesian posterior probabilities/maximum likelihood bootstrap/maximum parsimony bootstrap values. Support values less than 50% are not shown. Scale bar represents 0.01 substitutions per site.

from *U. gigantea*, and morphological characters clearly distinguish the species (Loughnane et al., 2008). *Ulva gigantea* sequences were characterized by the distromatic membranous thalli and usually possessed one pyrenoid per cell, which was quite different from *U. shanxiensis*.

Considering that *Enteromorpha salina* Kützing is now accepted as a taxonomic synonym of *Ulva prolifera*, and *U. percursa* (C. Agardh) C. Agardh is noted as unverified (Guiry & Guiry, 2014), the genus *Ulva* is represented by three freshwater species in China (Tseng, 1983; Li & Bi, 1998).

KEY TO THE CHINESE FRESHWATER SPECIES OF *ULVA* FROM CHINA

1a. Thalli with sparse branching ..... *U. intestinalis* L.
1b. Thalli with abundant branching.
  2a. Cell shape round to polygonal; cells with one pyrenoid each .... *U. prolifera* O. F. Müller
  2b. Cell shape polygonal to quadrate; cells with more than one pyrenoid .... *U. shanxiensis* L. Chen, J. Feng & S. L. Xie

Paratype. CHINA. Shanxi: Shuozhou City, Simabo Village, Shentou Spring, attached at the bottom of a stream, 9 June 2010, *L. Chen & B. Li SAS2010055* (SXU).

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Amaranthus parganensis (Amaranthaceae), a New Species from West Bengal, India

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Abstract. A new species of vegetable amaranth, *Amaranthus parganensis* Saubhik Das (Amaranthaceae), has been described from the lower Gangetic Plain of West Bengal, India. Its morphology and distributional range suggest that it is related to *A. tricolor* L., both adapted to tropical climate, having a sympatric distribution and similar ecology.

Key words: Amaranthaceae, *Amaranthus*, gynomonoecy, Indo-Gangetic Plain, IUCN Red List, West Bengal.

Amaranthus L. (Amaranthaceae) is a cosmopolitan genus of herbs comprising ca. 60 to 70 species (Sauer, 1976), of which ca. 40 are native to the Americas, the rest distributed across Australia, Africa, Asia, and Europe. Most are annual weeds, and a few are valued as vegetable and ornamental amaranths. The protein-rich seeds of species such as *A. hypochondriacus* L., *A. caudatus* L., and *A. cruentus* L. are consumed as pseudocereals; these taxa are known as the grain amaranths. Sauer (1955) accepted two subgenera under genus *Amaranthus*, with *Amaranthus* subg. *Acnida* (L.) Aellen ex K. R. Robertson having dioecious species and *Amaranthus* subg. *Amaranthus* identified by its monoecious species. Traditionally, *Amaranthus* subg. *Amaranthus* has been divided into two sections, as *Amaranthus* sect. *Amaranthus* [= *Amaranthus* sect. *Amaranthotypus* Dumort.] and *Amaranthus* sect. *Blitopsis* Dumort. s.l. (Thellung, 1919; Aellen, 1959; Robertson, 1981). Carretero (1985) split *Amaranthus* sect. *Blitopsis* into two sections: *Amaranthus* sect. *Blitopsis* s. str., comprising species with indehiscent fruits, and *Amaranthus* sect. *Pyxidium* Moq., including species with dehiscent fruits. More recently, Mosyakin and Robertson (1996) recognized three subgenera on the basis of inflorescence and floral features, as *Amaranthus* subg. *Acnida*, *Amaranthus* subg. *Amaranthus*, and *Amaranthus* subg. *Albersia* (Kunth) Gren. & Godr., and moved section *Pyxidium* from subgenus *Amaranthus* to subgenus *Albersia*. All the grain amaranths, along with few weeds, are included in *Amaranthus* sect. *Amaranthus*. Vegetable amaranths are included in *Amaranthus* subg. *Albersia*, which is taxonomically complex and is currently divided into four sections: *Amaranthus* sect. *Blitopsis*, *Amaranthus* sect. *Pentamorion* (Beck) Mosyakin & K. R. Robertson, and *Amaranthus* sect. *Goerziella* (Urb.) Mosyakin & K. R. Robertson, which comprise indehiscent-fruited species, and *Amaranthus* sect. *Pyxidium*, which includes taxa with dehiscent, circumscissile utricles (Mosyakin & Robertson, 1996). Few species of *Amaranthus*, such as *A. tricolor* L., *A. blitum* L., *A. cruentus*, and *A. dubius* Mart. ex Thell. are used as leafy vegetables, but the most widely cultivated members are *A. tricolor* and *A. blitum*. *Amaranthus tricolor* is included in section *Pyxidium* and *A. blitum* is included in section *Blitopsis*. A deep red-colored, dark-seeded form of grain amaranth, *A. cruentus* is used as a leafy vegetable in tropical African and Caribbean regions. Weedy species *A. dubius*, included in *Amaranthus* nothosect. *Dubia* Mosyakin & K. R. Robertson, is often used as a green vegetable in West America and the Caribbean. Vegetable amaranths are included in *Amaranthus* sect. *Pyxidium* of subgenus *Albersia*, and this appears to be the least satisfactory taxonomic grouping within the genus. *Amaranthus tricolor* is included within *Amaranthus* sect. *Pyxidium* and is morphologically variable. Further, the morphological distinctiveness of Indian populations within *Amaranthus* are independently recognized, and a novel species is described herein.

Amaranthus parganensis Saubhik Das, sp. nov. TYPE: India. West Bengal: North 24 Parganas, Salt Lake City, EM bypass, sea level, 27 Sep. 2010, *S. Das s.n.* [specimen no. 17] (holotype, CAL; isotype, MO). Figure 1.

Species nova *Amarantho tricolori* L. affinis, sed ab eo laminae foliaris cum petiolo proportione majore, floribus hermaphroditis et pistillatis, hermaphroditis quam pistillatis multo majoribus, tepalis apice acuminatis atque fructu in tepalo longiore semper incluso distinguitur.

Robust herbs, 100–120 cm tall, appearing gynomonoecious, but not functionally; stems erect, green, branched. Leaves exstipulate, spirally arranged, blades green, ovate to lanceolate or lanceolate but not rhombic, 13–17 cm × 5–9 cm, blade apices ±



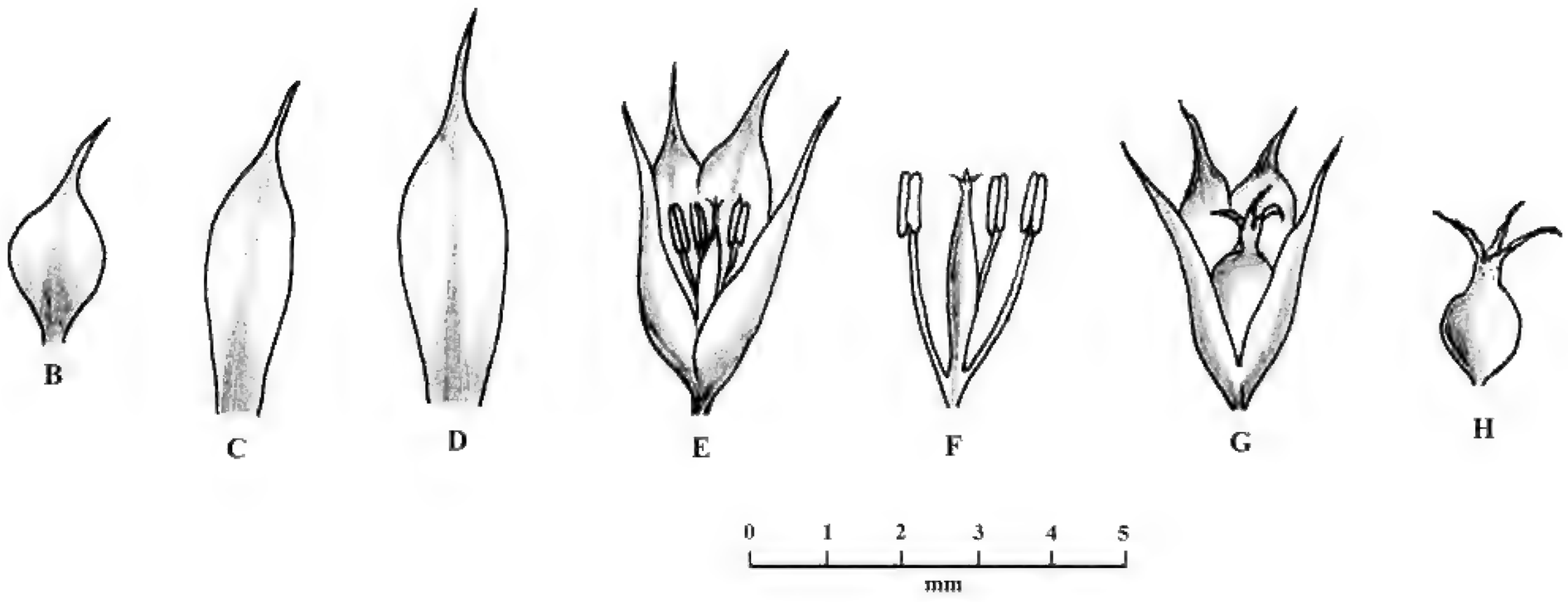


Figure 1. *Amaranthus parganensis* Saubhik Das. —A. Fertile habit. —B. Aristate bract. —C. Aristate bracteole. —D. Aristate tepal. —E. Bisexual flower. —F. Arrangement of stamens and rudimentary carpel in bisexual flower. —G. Pistillate flower. —H. Gynoecium from pistillate flower. A–H are drawn from the CAL type *Das s.n.* [17].

acute or often minutely notched, with a minute apiculum, blade bases cuneate; petioles green, 5–8 cm. Flowers in small axillary glomerules and as a terminal compound inflorescence of cymes; terminal inflorescence massive but less branched. Flowers either bisexual or pistillate, unequal in size, intermixed, ± sessile, the tepals of bisexual flowers larger than those of pistillate flowers; bracts,

bracteoles and tepals with apical awns; bracts and bracteoles broadly ovate to lanceolate, 1.5–2 mm; tepals 3, ovate to lanceolate or oblong, membranous, apex acuminate, tepal length 4.5–5 mm in bisexual flowers, 3–3.5 mm in pistillate flowers; stamens 3, free, filaments filiform, 4.5–5 mm in hermaphroditic flowers; stamens or staminodes are absent in pistillate flowers; carpels three, 2.5–3 mm, style short and thickened, ovary ovoid, stigmas 3, filiform, transparent, papillose, gynoecium in the bisexual flower with a short, thickened gynophore, gynoecium in the pistillate flower lacking a gynophore; the gynoecium rudimentary in bisexual flowers. Fruit a circumscissile utricle produced only by pistillate flowers, ovoid, 1.5–2 mm long, included by the much longer tepal, with fruit surface smooth; seeds blackish brown, shiny, compressed, 1.2–1.5 mm diam.

Distribution and habitat. *Amaranthus parganensis* occurs in the lower Gangetic Plain of West Bengal. It grows extensively in North and South 24 Parganas, and has also been collected from Hooghly, Howrah, Midnapur, Burdwan, and Nadia districts in West Bengal. The new species is cultivated as a vegetable crop and is also found in open areas. There is no previous record of this species as evident from herbarium vouchers examined by the author.

IUCN Red List category. *Amaranthus parganensis* is assessed as Data Deficient (DD), according to IUCN (2001) categories and criteria. Currently there is inadequate information to make a direct or indirect assessment of its risk of extinction based on the distribution and/or population status of the new species.

Phenology. After germination from seed, *Amaranthus parganensis* matures within 50 to 60 days as revealed from study in its natural habitat. It has been observed to flower in the months of September to October, with seeds in November to December.

Etymology. The specific epithet is taken from the Latin in reference to the geographic region where the new species grows extensively.

Discussion. The new species is assigned to *Amaranthus* subg. *Albersia*, as a vegetable amaranth. *Amaranthus parganensis* is further assigned within this subgenus to *Amaranthus* sect. *Pyxidium* due to the dehiscent utricles. Other species of vegetable amaranths growing in West Bengal, India (*A. tricolor*, *A. blitum*) are generally monoecious and are also self compatible. Breeding mechanisms in amaranths are complex and variable. The vegetable amaranths have a number of staminate flowers per glomerules and are predominantly self pollinating (Pal & Khoshoo, 1973). Vegetable amaranths are predominantly a self-pollinating crop, with varying degrees of outcrossing (Hauptli & Jain, 1985). The new species shows a structural gynomonoecy, although gynoecia are rudimentary. There is no functional gynomonoecy and no seeds were found within the rudimentary carpels of bisexual flowers. Among the three subgenera as delimited by Mosyakin and Robertson (1996), subgenus *Acnida* comprises only dioecious species, while the other two, subgenus *Albersia* and subgenus *Amaranthus*, comprise only monoecious species. There are no records of any other amaranths having gynomonoecy or incipient gynomonoecy.

In general appearance and morphology, *Amaranthus parganensis* closely resembles *A. tricolor*. Both species are distinguished by common features such as the erect habit, leaf size, bracts smaller than the tepal, and the fruit as a dehiscent, circumscissile utricle with a smooth surface and blackish brown seeds. *Amaranthus tricolor* has significant morphological variability, and some of its morphotypes have been given varietal status (Das, 2013). In India, Pan et al. (1992) studied 45 indigenous and exotic genotypes of *A. tricolor*, using 10 qualitative traits to explore differences among the genotypes. Devdas et al. (1992) found greater variability in the morphotypes of *A. tricolor* than exhibited by the morphotypes of *A. dubius*, *A. spinosus* L., and *A. viridis* L. Both *A. parganensis* and *A. tricolor* occur sympatrically, although the distribution of *A. tricolor* is much broader, cultivated as a leafy vegetable in Asia and as a green crop in Africa. Another vegetable amaranth, *A. blitum*, may be a close associate of the new species but *A. blitum* differs from the new species being a much smaller plant with smaller leaves and other differences in flower and fruit (cf. Table 1). Dispersal of the fruit and seeds of *Amaranthus* species is often performed by humans (Costea et al., 2004; Iamonico, 2010, 2012), which would obscure native distributions of these taxa.

Key to *Amaranthus* Species in West Bengal, India

1a. Fruit dehiscent ..... 2.
1b. Fruit indehiscent ..... 3.
2a. Monoecious, flowers unisexual ..... 4.
2b. Incipient gynomonoecious, flowers either pistillate or bisexual with rudimentary gynoecia ..... *A. parganensis* Saubhik Das

Table 1. Comparative morphology of *Amaranthus parganensis* Saubhik Das, *A. tricolor* L., and *A. blitum* L.

Morphological characteristics	*A. parganensis*	*A. tricolor*	*A. blitum*
Breeding system	incipiently gynomonoecious	monoecious	monoecious
Stems	erect, 100–120 cm	erect, 90–100 cm	erect or ascending, 35–45 cm
Leaf shape	ovate to lanceolate or lanceolate, not rhombic	deltoid ovate or ovate to lanceolate or oblong	ovate to lanceolate or rhomboid ovate
Leaf sizes	13–17 × 5–9 cm	9–17 × 5–9 cm	2.5–8 × 1.5–6 cm
Ratio of lamina to petiole lengths	2.1–2.6:1	0.89–1.66:1	0.5–1.5:1
Leaf apices	acute or minutely notched	acute or slightly emerginate	emerginate
Inflorescences	terminal inflorescence massive but less branched	terminal inflorescence massive and much branched	terminal inflorescence short
Flowers	both bisexual and unisexual; bisexual and female flowers unequal	unisexual; staminate and pistillate flowers equal	unisexual; staminate and pistillate flowers equal
Bract vs. tepal	bract < tepal	bract < tepal	bract ≤ tepal
Bract length	1.5–2 mm	1.5–2 mm	0.5–2.5 mm
Tepal shape	ovate to lanceolate or oblong	ovate to lanceolate or spathulate	lanceolate to spathulate
Tepal tip	acuminate	acute or awned	acute or obtuse
Tepal length	3–5 mm	2.25–2.5(−5) mm	1.2–2.5 mm
Fruit vs. tepal	fruit included by longer tepal	fruit may or may not exceed tepal	fruit marginally exceeding tepal
Fruit surface	smooth	smooth	faintly rugose
Fruit length	1.5–2 mm	1.5–2 mm	1.5–2.8 mm
Dehiscence	circumscissile utricle, dehiscent	circumscissile utricle, dehiscent	indehiscent
Seed diameter	1.2–1.5 mm	1.2–1.5 mm	1.1–1.8 mm
Seed color	blackish brown	blackish brown	black

3a. Stems erect or ascending; terminal inflorescence simple, short; fruit surface faintly rugose; seeds 1.1–1.8 mm diam ..... *A. blitum* L.
3b. Stems erect, terminal inflorescence complex, thyrsoid, fruit surface very rugose; seeds 1 mm diam. ..... *A. viridis* L.
4a. Staminate and pistillate flowers intermixed; stems and leaves red, reddish green or green ..... 5.
4b. Staminate and pistillate flowers not intermixed, with staminate flowers usually clustered at inflorescence apices; stems and leaves green ..... 6.
5a. Tepals 3; stamens 3; bract smaller than tepals; seeds brownish black, 1.2–1.8 mm diam. ..... *A. tricolor* L.
5b. Tepals 5; stamens 5; bract much longer than tepals; seeds black, 1 mm diam. ..... *A. hybridus* L.
6a. Presence of paired divergent spines at the nodal region; bracts ovate to lanceolate; utricle irregularly dehiscent ..... *A. spinosus* L.
6b. Absence of paired spines at nodes; bracts lanceolate; utricle circumscissile ..... *A. dubius* Mart. ex Thell.

Paratypes. INDIA. **West Bengal:** Burdwan distr., Memari, 29 Sep. 2010, *S. Das* (CAL); Hooghly distr., Arambagh, 1 Oct. 2010, *S. Das* (CAL); Howrah distr., Baksara, 3 Oct. 2010, *S. Das* (CAL); West Midnapur distr., Jhargram, 10 Oct. 2010, *S. Das* (CAL); Nadia distr., Kalyani, 15 Oct. 2010, *S. Das* (CAL); South 24 Parganas distr., Basanti, 22 Oct. 2010, *S. Das* (CAL); North 24 Parganas, Dhapa, Salt Lake, 24 Oct. 2010, *S. Das* (MO).

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A New Species of *Nigella* (Ranunculaceae) from Northeastern Turkey

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ABSTRACT. *Nigella* L. (Ranunculaceae) is distributed worldwide and is primarily centered in the Mediterranean region. Fourteen species are reported from Turkey, 10 of which are native. Specimens of the new species, *N. koyuncui* Dönmez & Uğurlu, were collected from Sinop, Turkey. It is distinguished from *N. arvensis* L. s.l. by several characters, including the dark red to purplish red central blotch of flowers, the whitish yellow sepals, yellow petals, large nectary pairs, and grouped stamens. Chromosomes of the new species have been studied for the first time, and the diploid number ($2n$) has been found to be 12.

Key words: Chromosome number, IUCN Red List, *Nigella*, Ranunculaceae, Turkey.

Taxa of *Nigella* L. (Ranunculaceae) fall into two major groups with respect to flower color, which is either yellow or blue with color variations within each group. The *N. arvensis* L. complex has bluish flowers, and the new species *N. koyuncui* Dönmez & Uğurlu, described here, is distinctly close to this complex by its entire set of characters, except as distinguished by the flower colors and features given in Table 1. During our monographic study, we recognized a *Nigella* specimen as a distinct species by its yellow flowers in the field (Dönmez et al., 2011a). Comparative studies in the floristic literature support our conclusion that this new species is affined to the *N. arvensis* complex yet is distinct by several character differences (Krasheninnikov, 1937; Davis, 1965; Meikle, 1977; Townsend, 1980; Pignatti, 1982; Zohary, 1983; Amich, 1986; Riedl, 1992; Tutin & Akeroyd, 1993; Strid, 2002). We discuss pollen and seed morphology of this new species and its close relatives and provide SEM micrographs. Chromosomes of the new species have been counted, giving a diploid number ($2n$) of 12.

Nigella koyuncui Dönmez & Uğurlu, sp. nov. TYPE: Turkey. Sinop: Boyabat, Uzunçay Village, 41°38′N 034°36′E, 442 m, 7 July 2009, *A. A. Dönmez & Z. Uğurlu 15801* (holotype, HUB; isotypes, AEF, HUB, MO). Figure 1.

Haec species *Nigellae arvensi* L. affinis, a qua tamen macula centrali florum majore atrosanguinea vel violacea, sepalis albo-luteis, petalis aureis, nectariis majoribus et staminibus in fasciculos 8 insertis differt.

Annual herb, erect, simple to branched from base; stems glabrous to finely scabrid, 5–25 cm, striate. Leaves glabrous to scabrid, distributed throughout stem length; basal leaves petiolate, to 15 mm; lamina 5–25 × 8–20 mm, orbicular to obovate in outline, 2- to 3-pinnatisect, ultimate segments linear, 3–6 × 0.3–0.4 mm; stem leaves sessile or petiolate to 1–2 mm, 1- or 2-(3-) pinnatisect. Flowers solitary or 2- to 7-flowered raceme. Flowers 10–22 mm diam., with dark blood-red to purplish red central blotch; sepals 5, whitish to pale yellow with green midrib evident dorsally, divided into claw and limb; claw 3–5 mm in length; limb 4–8 × 4–7 mm, deltoid to orbicular, shortly attenuate to truncate at base, briefly cuspidate at apex, veins distinct, glabrous; petals (7)8, yellow, 4–5 × 2–3 mm with 4 to 10 long hairs, distinctly geniculate, upper (inner) lip widely triangular at lower half, 1 × 0.5 mm, upper half filiform, 1.8–2 mm, slightly clavate with purplish single transverse line at apex; lower (outer) lip widely ovate in outline; deeply divided into ovate halves, each half 2 mm, abruptly constricted into filiform portion, apex slightly clavate with single purplish line; nectaries green, as conic protuberance, with purplish single line, covering the petal base; stamens 40, in 8 groups, filaments 3–5 mm, anthers 1.9–2.1 mm, with apical appendage, greenish yellow, yellow at maturity. Capsules 2 to 4 per flower, 20–24 × 2–3 mm (including apical beak), smooth, slightly tuberculate on ventral suture, connate to half capsule length, beaks ca. equal to capsule, each capsule with 3 (to 5) distinct veins; seeds 2–2.1 × 1.4–1.6 mm, mostly triquetrous, with

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Table 1. Morphological differences between *Nigella koyuncui* Dönmez & Uğurlu and *N. arvensis* L. s.l.

	N. koyuncui	*N. arvensis* s.l.
Sepal color	whitish to pale yellow	bluish to greenish white, rarely white
Petal color	yellow	from blue to light brown
Color of central blotch of flower	dark red to purplish red	absent or dark violet
Ornamentation of outer petal lobes	one transverse line at apex	more than one transverse line
Nectary	covering the petal base	covering half or less of the petal base
Stamens	40, in groups of 8	20–45, but not in groups (or rarely)

black and a few white tubercles, indistinctly winged on margin.

Distribution. *Nigella koyuncui* is endemic to northeastern Turkey in Sinop Province. The locality is considered an element of the Irano-Turanian floristic region. The new species is known only from populations at two locations.

IUCN Red List category. *Nigella koyuncui* is known from two localities 20 km away from each other. Field studies at the first location near the village of Uzunçay revealed more than 100 mature individuals. The second population at Çayköy is composed of approximately 50 individuals. We surveyed other likely locations for additional populations of the species in the region. Unfortunately, new populations were not found because the species is not widespread. We have evaluated the data gained from the field studies according to the IUCN categories (Criteria B1a) (IUCN, 2001), and we propose the conservation status of Endangered, or EN, for *N. koyuncui*.

Phenology. *Nigella koyuncui* has been observed to flower from July to August.

Etymology. The epithet of *Nigella koyuncui* honors the Turkish taxonomist Prof. Dr. Mehmet Koyuncu (1944–) from Boyabat, which is the type locality of the species.

Discussion. Since their initial descriptions, *Nigella*, *Garidella* L., and *Komaroffia* Kuntze have been evaluated at different infrageneric levels by various authors. In a recent classification of the tribe Nigelleae, Tamura (1993) accepted them at the generic level, and we follow this treatment here.

The taxa of the *Nigella arvensis* complex are found from the Azores Islands to Kyrgyzstan with approximately 10 species and 40 subspecific taxa, according to the local floras mentioned above. Besides this, a new classification for the species has been recently proposed (Dönmez et al., 2011a), and *N. arvensis* is represented by three varieties worldwide. *Nigella koyuncui* is closely allied to this species in respect to habit, leaf, and fruit shape. Owing to several characters discussed below and detailed in Table 1, the specimens we have studied here are described as a new species.

The showy flowers of *Nigella* taxa are their most prominent feature and have been extensively used to distinguish them. The principal flower colors in *Nigella* taxa are blue and yellow, but whitish, brownish, and greenish variants are also present in some species. With respect to these flower colors, the genus has been divided into three groups identified as the *N. arvensis* complex, with blue color; the *N. orientalis* L. complex, with yellow color; and the *N. unguicularis* (Poir.) Spenn. complex, with brownish color. The first two groups remain included in *Nigella*, according to a recent generic classification (Tamura, 1993), while the third group is referred to *Garidella*.

The flower color of *Nigella koyuncui* is close to the *N. orientalis* complex, with both being characterized by yellow flowers. However, other floral characters affine the new species with *N. arvensis* s.l., but it can be otherwise distinguished by several characters. Sepal color of the *N. arvensis* complex is basically blue or variants of blue, but it has been mentioned as rarely dirty white by Davis (1965) or ashy white by Strid (2002). These variants have been seen among the *N. arvensis* complex during field trips in Turkey, Syria, and Greece. The dirty white or ashy white coloration is a paler variant of blue, and the color of the sepals becomes more bluish when dried. In contrast, the sepal color of *N. koyuncui* is clearly whitish or yellowish white, and this coloration is distinctly yellowish when dried. Furthermore, the yellowish color remains distinctive in specimens collected two decades ago. Approximately 100 specimens have been observed at the type locality, and in all of these the petal color is pure yellow, and there is no variation or suffusion with another color.

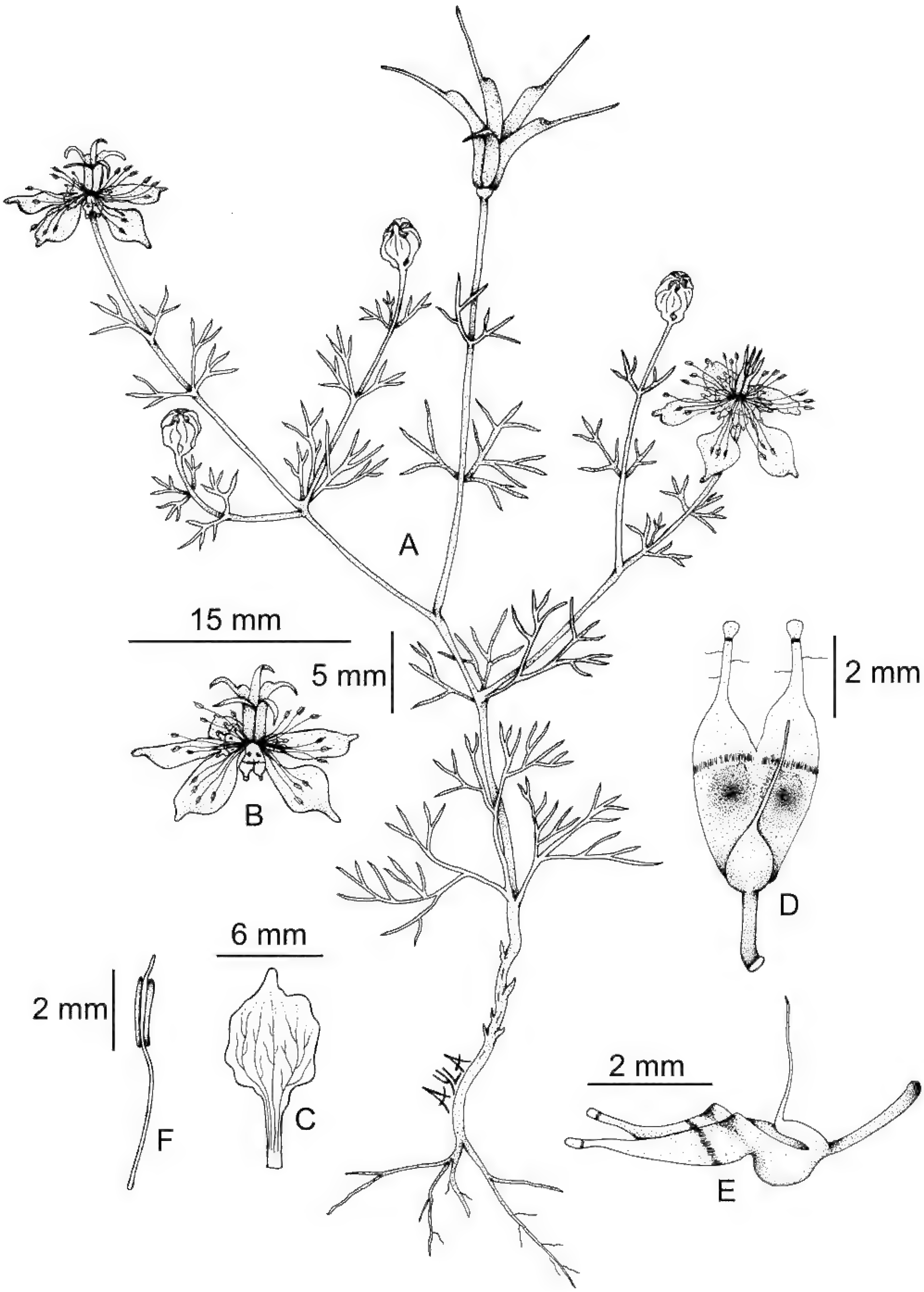


Figure 1. *Nigella koyuncui* Dönmez & Uğurlu. —A. Fertile habit. —B. Flower. —C. Sepal. —D, E. Petal. —F. Stamen. A–F, drawn from the HUB holotype *A. A. Dönmez & Z. Uğurlu 15801*.

Pollen morphology of the *Nigella* taxa is not useful at the species level but does confirm the genus placement. The pollen of *N. koyuncui* is trizonocolpate, polar length is 32.5–40 μm, equatorial length is 35–41.25 μm, pollen shape is oblate spheroidal, amb is circular, and apocolpium index is 0.27. Detail of the exine ornamentation at the mesocolpium can be seen in Figure 2A. Seed morphology of *Nigella* taxa is a subject for detailed research, and an identification key has been prepared (Dadandi et al., 2009;

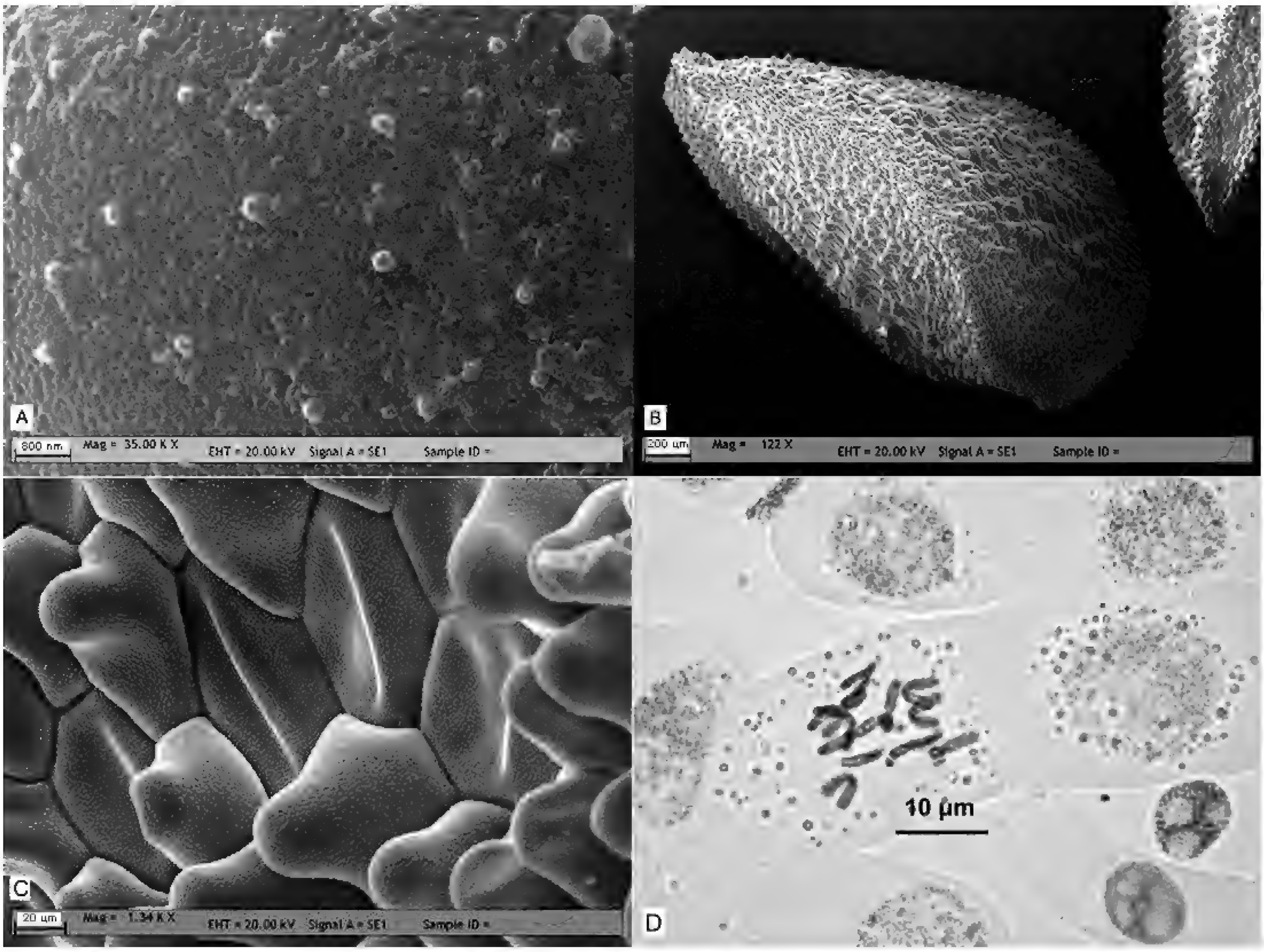


Figure 2. *Nigella koyuncui* Dönmez & Uğurlu. —A. Pollen, exine ornamentation at the mesocolpium. Taken from the HUB paratype *A. Dönmez & Z. Uğurlu 17223*. B, C. Seed morphology. —B. Intact seed view. —C. Closer view of seed coat ornamentation. B, C, taken from the HUB paratype *A. Dönmez & Z. Uğurlu 17475*. —D. Chromosomes, showing $2n = 12$. Root tip preparation taken from the HUB paratype *A. Dönmez & Z. Uğurlu 17475*.

Dönmez et al., 2011b; Heiss et al., 2011). SEMs of the new species *N. koyuncui* appear in Figures 2B and 2C. The diploid chromosome number ($2n$) of the *N. arvensis* complex is 12 (Strid, 1970). The same diploid number ($2n$) has been confirmed for the new species (Fig. 2D).

Paratypes. TURKEY. **Sinop:** Boyabat, Uzunçay village, 41°38′N 034°36′E, 442 m, 7 Aug. 2009, *A. A. Dönmez & Z. Uğurlu 16019* (HUB), *A. Dönmez & Z. Uğurlu 17223*, *A. Dönmez & Z. Uğurlu 17475* (HUB); Boyabat, Çayköy village, 550 m, 21 July 1993, *A. A. Dönmez 3664*, with *H. Şağban & A. Kahraman* (HUB).

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Three New Subspecies of *Monardella* (Lamiaceae) from Southern California, U.S.A.

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Abstract. Continuing work on the flora of California after the publication of *The Jepson Manual: Vascular Plants of California* has led to the discovery of three new *Monardella* Benth. (Lamiaceae) subspecies: *M. australis* Abrams subsp. *gabrielensis* Elvin & A. C. Sanders, *M. australis* subsp. *occidentalis* Elvin, R. A. Burgess & A. C. Sanders, and *M. sinuata* Elvin & A. C. Sanders subsp. *gerryi* Elvin, A. C. Sanders & R. A. Burgess. *Monardella australis* subsp. *gabrielensis* occurs in the central and western San Gabriel Mountains of the Transverse Ranges, and *M. australis* subsp. *occidentalis* occurs on Pine Mountain Ridge in the Western Transverse Ranges and the San Rafael Mountains of the adjacent southern portion of the South Coast Ranges. The two new subspecies of *M. australis* are most similar to the autonymic subspecies, but both differ in their bract and leaf morphology, pubescence on the stems and calyces, stature, and distribution. *Monardella sinuata* subsp. *gerryi* occurs in the Las Posas and Camarillo Hills in the coastal plain of Ventura County in the South Coast Region. The new subspecies is most similar to *M. sinuata* subsp. *sinuata* but differs in its stem, leaf, bract, and glomerule size and in its pubescence, nutlets, and ecological setting. *Monardella neglecta* Greene is transferred to a new rank as a subspecies of *M. purpurea* Howell, as *M. purpurea* subsp. *neglecta* (Greene) Elvin & A. C. Sanders. It is a diminutive, glabrous, serpentine endemic on the Marin and Tiburon peninsulas in northern California. A taxonomic assessment of names within the *M. villosa* Benth. complex results in the synonymy of *M. franciscana* Elmer to *M. villosa* subsp. *villosa*. *Monardella villosa* subsp. *subserrata* (Greene) Epling is recognized as the upland and interior taxon in this species. A lectotype is designated for *M. purpurea* Howell and recognized for both *M. franciscana* Elmer and *M. neglecta* Greene.

Key words: California, IUCN Red List, Lamiaceae, *Monardella*, San Gabriel Mountains, South Coast Ranges, Transverse Ranges.

Monardella Benth. (Lamiaceae) occurs throughout western North America from northern Mexico to southern Canada with 59 taxa distributed among 35 species. California is the center of diversity for *Monardella* with 52 taxa distributed among 30 species (Sanders et al., 2012). Recent work for *The Jepson Manual: Vascular Plants of California* (Baldwin et al., 2012) has stimulated continuing taxonomic investigation of *Monardella*. Work on a flora of Ventura County, California (Burgess & Munro, in prep.), and other ongoing local projects has led to further discoveries in *Monardella*. Most of the taxa in this genus have very limited distributions, which is also the case for the three new subspecies described herein.

Taxonomically important characters in Monardella. The main morphological characters that have been used over time to distinguish between taxa in the genus *Monardella* include plant habit and leaf, bract, and inflorescence morphology (Gray, 1876,

1886; Abrams, 1912a, 1912b, 1951; Epling, 1925, 1939; Jepson, 1925, 1943; Munz, 1935, 1959, 1974; Jokerst, 1993). While these historically used characters can be highly variable (e.g., leaf morphology, stem length) within a single taxon, they can still be helpful for identification, especially when used in tandem. Other characters (e.g., calyx length, bract morphology) can be variable in some taxa but are more consistent in others. More recently, we have found pubescence (i.e., of leaf, stem, calyx) to be among the most stable of characters used to distinguish between species and subspecies in *Monardella* (Elvin & Sanders, 2003, 2009; Sanders et al., 2012; Elvin et al., 2013).

We have noticed that each plant structure (e.g., leaf, stem, calyx, bract) in *Monardella* generally has its own distinct pubescence, and each can have one to several different types of trichomes that are intermixed on these structures. For example, *M. robisonii* Epling has one type of glandular trichome and two types of non-glandular trichomes all intermixed on the stems. Unfortunately, many of the different types of pubescence are minute, with some as small as 0.01–0.03 mm in length. Trichomes of this size cannot be seen reliably with a standard 10× hand lens, but they can be distinguished with the use of a microscope. The trichomes do not lend themselves to easy identification in the field, but they do provide for accurate identification.

As noted below, there are differences between the new subspecies and their sister subspecies in many of the standard, old characters (e.g., leaf morphology, stem length); however, in many instances there is overlap between taxa at the edge of the character ranges (e.g., leaf length). The three new subspecies presented below are unequivocally distinct from their sister subspecies in pubescence characters (e.g., stem, bract, calyx).

1. Monardella australis Abrams, Muhlenbergia 8: 34. 1912. *Monardella odoratissima* Benth. subsp. *australis* (Abrams) Epling, Ann. Missouri Bot. Gard. 12: 70–71. 1925. *Monardella odoratissima* Benth. var. *australis* (Abrams) Jeps., Fl. Calif. [Jepson] 3: 437. 1943. TYPE: U.S.A. California: Riverside Co., open forests of Tamarack Valley, July 1901, *H. M. Hall 2486* (holotype, DS; isotypes, MO, UC not seen).

Monardella australis is a caespitose, mat-forming rhizomatous perennial to subshrub distinguished by having long non-glandular trichomes, 0.3–0.6 mm with minute glandular trichomes, 0.02–0.04 mm beneath. It occurs in montane areas at 1350–3300 m in elevation in the Peninsular and Transverse ranges of southern California.

1a. Monardella australis subsp. **australis**. Figure 1A.

Monardella australis subsp. *australis* occurs in mid-montane to subalpine forest, chaparral, rocky openings, at 1450–3300 m in elevation in the San Jacinto and San Bernardino mountains, in Riverside and San Bernardino counties, respectively, in southern California. It is distinguished from the other *M. australis* subspecies by its long calyces (greater than 8.5 mm) and long, purple bracts (12–18 mm) that exceed the calyces.

1b. Monardella australis subsp. **cinerea** (Abrams) A. C. Sanders & Elvin, Novon 19(3): 323. 2009. *Monardella cinerea* Abrams, Muhlenbergia 8: 33. 1912. TYPE: U.S.A. California: Los Angeles Co., Mt. San Antonio [Mt. Baldy], 9000 ft. or more, 24 July 1901, *L. R. Abrams 1928* (holotype, DS; isotypes, MO photo of holotype sheet, OSC not seen). Figure 1B.

Monardella australis subsp. *cinerea* occurs in mid-montane to subalpine forest and is endemic to the upper elevations (1800–3100 m) in the San Gabriel Mountains in Los Angeles County, California. It is distinguished from the other *M. australis* subspecies by its short stems (3–15 cm), very short internodes (3–8[10] mm), short leaves (5–10 mm), the grayish hue of its herbage, and its short calyces (5–7[8] mm).

1c. Monardella australis subsp. **gabrielensis** Elvin & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: Los Angeles Co., San Gabriel Mtns., NE face of Pacifico Mtn., 2051 m., 27 Sep. 2011, *D. E. Bramlet, E. Kentner & J. Zylstra 4972* (holotype, UCR; isotypes, JEPS, LA, MO, SBBG, US, VFWO). Figures 1C, 2.

Diagnosis. The new subspecies is similar to *Monardella australis* Abrams subsp. *australis*, but differs in having green to stramineous bracts (vs. purple or rose-tinged in subsp. *australis*) that are shorter ([5]6.5–9 mm vs. 12–18 mm) and narrower (2–4.5 mm vs. 4–8 mm), shorter calyces (7–8 mm vs. 8.5–10 mm), and in lacking non-glandular calyx trichomes.

Caespitose perennials to subshrubs, (6)15–25 cm tall, tufted to matted; rhizomatous; stems visibly woody at base, pubescence dense, with 2 types of stem trichomes, (1) glandular, 0.02–0.04 mm and (2) non-glandular, 0.3–0.6 mm. Leaves (6)10–19(21) × (2.2)3.5–5(6) mm, narrowly to widely elliptic, sessile, pale or grayish green; with 2 types of trichomes on

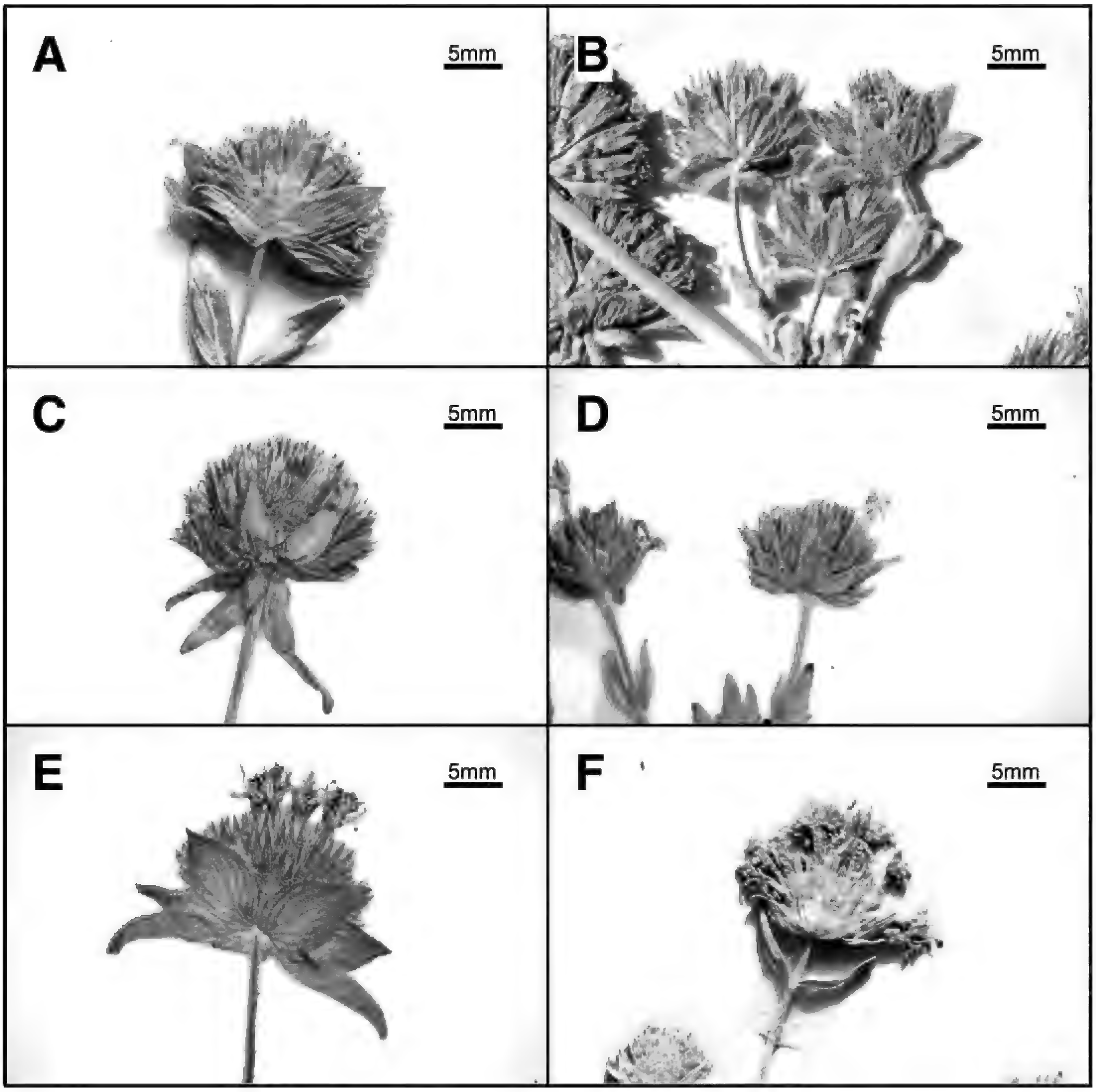


Figure 1. A–F. Glomerules and bracts of *Monardella* Benth. subspecies in southern California. —A. *Monardella australis* Abrams subsp. *australis*. —B. *Monardella australis* subsp. *cinerea* A. C. Sanders & Elvin. —C. *Monardella australis* subsp. *gabrielensis* Elvin & A. C. Sanders. —D. *Monardella australis* subsp. *jokerstii* Elvin & A. C. Sanders. —E. *Monardella australis* subsp. *occidentalis* Elvin, R. A. Burgess & A. C. Sanders. —F. *Monardella linoides* A. Gray subsp. *erecta* (Abrams) Elvin & A. C. Sanders. A, photographed from *McClintock s.n.* (LA-62613); B, from *L. Abrams 1928* (holotype, DS); C, from *D. E. Bramlet, E. Kentner & J. Zylstra 4972* (holotype, UCR); D, from *M. A. Elvin & K. VinZant 5085* (isotype, IRVC); E, from *R. A. Burgess, M. A. Elvin & L. Simpson 9700* (holotype, UCR); F, from *L. Abrams 2861* (isotype, US). All images taken and prepared by Michael R. Tiffany.

adaxial blade surface, (1) glandular, 0.02–0.04 mm (dense) and (2) non-glandular, 0.4–0.6 mm (sparse to dense); 1 type of trichome on abaxial blade surface, glandular, 0.02–0.04 mm (sparse to dense); leaves subsessile to decurrent, base acute to obtuse, apex acute to obtuse, rounded. Inflorescence a terminal glomerule on primary stems, solitary; glomerules 10–18 mm wide; bracts (5)6.5–9 × 2–4.5 mm, green to stramineous, occasionally purple-tinged distally, narrowly elliptic to narrowly lanceolate, apices acute, less than or equaling the calyces. Flowers with the calyx 7–8 mm, green, rarely purple or rose-tinged distally, the calyx with 2 types of trichomes, (1) glandular, 0.1–0.2 mm and (2) glandular, 0.4 mm (sparse), but non-glandular trichomes absent; corolla 12–14 mm, white to cream with fine purple markings that make the corolla appear lavender in general color; stigma 14–17 mm, exserted; stamens 14–16 mm, exserted. Fruit a nutlet, tan to light brown, mottled dark brown, oblong, 2.2–2.3 × 0.8–0.9 mm.



Figure 2. *Monardella australis* Abrams subsp. *gabrielensis* Elvin & A. C. Sanders. Holotype, *D. E. Bramlet E. Kentner & J. Zylstra 4972* (UCR).

Distribution and habitat. *Monardella australis* subsp. *gabrielensis* is endemic to the north central San Gabriel Mountains in the Transverse Ranges of southern California. It occurs in openings in montane coniferous forest, montane coniferous woodland, and canyon live oak woodland that sometimes has a montane chaparral understory. The new subspecies most commonly occurs in either colluvium of decomposed granite/grandiorite soils or granitic outcrops at 1600–2200 m in elevation. Associated dominants in these areas include Cupressaceae such as *Calocedrus decurrens* (Torr.) Florin, Pinaceae such as *Pinus jeffreyi* Balf. and *P. lambertiana* Douglas, and Fabaceae such as *Quercus chrysolepis* Liebm. Other commonly associated species include Poaceae such as *Bromus tectorum* L. and *Poa secunda* J. Presl;

Asteraceae such as *Ericameria nauseosa* (Pall.) G. L. Nesom & G. I. Baird, *Eriophyllum confertiflorum* (DC.) A. Gray, and *Hulsea vestita* A. Gray subsp. *gabrielensis* Wilken; Onagraceae such as *Gayophytum diffusum* Torr. & A. Gray; Orobanchaceae such as *Cordylanthus nevinii* A. Gray; Polygonaceae such as *Eriogonum nudum* Douglas ex Benth. and *E. umbellatum* Torr.; and Rubiaceae such as *Galium jepsonii* Hilend & J. T. Howell.

IUCN Red List category. *Monardella australis* subsp. *gabrielensis* has a restricted distribution in the north-central San Gabriel Mountains. Using historical and current records, the new subspecies has an extent of occurrence (EOO) of approximately 148.6 km² (minimum convex polygon) and an area of occupancy (AOO) of approximately 8 km² (sum of occupied grid squares). All collections have been made within the boundaries of the Angeles National Forest (U.S. Department of Agriculture), which is managed for many uses. This may provide some protection, but it may also result in threats to the species, too, depending on the land use. Given the uncertainty regarding climate change, the extremely limited distribution and fragmentation, and the increase in megafires (fires that burn large areas [e.g., 100,000 acres] and have considerable effects on humans) in southern California, it is assessed here as CR, or Critically Endangered (CR B2ab[i,iii,iv,v]), according to IUCN criteria (2001).

Phenology. Plants of *Monardella australis* subsp. *gabrielensis* have been documented to flower between mid-July and mid-September.

Etymology. The Latin epithet *gabrielensis* refers to the San Gabriel Mountains, in which this subspecies' entire range occurs.

Taxonomic affinities. *Monardella australis* subsp. *gabrielensis* is closely related to the three previously described subspecies of *M. australis* (subspecies *australis*, *cinerea*, and *jokerstii*) and to the new *M. australis* subspecies described below in its habit, vestiture, and general morphology. This new subspecies overlaps in several gross morphological characters with the other subspecies of *M. australis*, such as stem height and leaf size, indicating their close relationship. However, *M. australis* subsp. *gabrielensis* can be distinguished by several morphological characters and occupies a separate geographic range. Prince (2009) conducted a population genetics analysis of several *Monardella* taxa from southern California, and her results indicate that *M. australis* plants in the San Gabriel Mountains are distinct from those in the San Bernardino Mountains.

Monardella australis subsp. *gabrielensis* is most similar to *M. australis* subsp. *australis* but differs from it in having glomerule bracts that are shorter ([5]6.5–9 mm vs. 12–18 mm in subspecies *australis*), narrower (2–4.5 mm vs. 4–8 mm), and green versus purple or rose-tinged, and in having bracts that are less than or equal to the calyces versus noticeably exceeding them (Fig. 1A, C). The calyces are shorter in *M. australis* subsp. *gabrielensis* (7–8 mm vs. 8.5–10 mm), with shorter (0.1–0.2 mm) glandular trichomes and sparse, longer glandular trichomes to 0.4 mm; these differ from *M. australis* subsp. *australis* and lack its minute (0.04–0.06 mm) glandular trichomes and longer (0.3–0.6 mm) non-glandular trichomes. Occasionally the sparse glandular trichomes 0.4 mm long on the calyces of *M. australis* subsp. *gabrielensis* can lose their glandular tips and appear to be non-glandular. The two subspecies have separate ranges, with the San Gabriel Mountains the range for subspecies *gabrielensis* and the San Bernardino and San Jacinto mountains the range for subspecies *australis*; however, there appears to be a zone of introgression with several specimens that represent putative intermediates between the two subspecies, for example, *R. G. Swinney 9256* (UCR, VFWO) and *R. G. Swinney 11330* (UCR).

Monardella australis subsp. *gabrielensis* is similar to and occurs adjacent to *M. australis* subsp. *cinerea* but can be distinguished from it by its longer corollas (12–14 mm vs. 9–11 mm in subspecies *cinerea*) and absence of minute (0.06 mm) glandular calyx trichomes and long (0.3–0.6 mm) non-glandular calyx trichomes. The two subspecies occur in different ecological settings and at different elevations (1600–2200 m vs. 1800–3100 m). While *M. australis* subsp. *cinerea* is also endemic to the San Gabriel Mountains, it appears not to overlap with subspecies *gabrielensis* in geographic ranges; however, there is at least one specimen (*R. L. Dressler 953* [LA]) that represents a putative intermediate between the two subspecies. More introgressant individuals are expected to be found.

Monardella australis subsp. *gabrielensis* is distinguished from *M. australis* subsp. *jokerstii* by its calyx pubescence (lacking the minute glandular 0.06 mm trichomes and long non-glandular 0.3–0.6 mm trichomes seen in subspecies *jokerstii*), leaf morphology (blades entire vs. serrate), inflorescence branching pattern (solitary glomerules vs. an open compound cyme of glomerules), the number of glomerules per main stem (one vs. one to five), and longer corollas (12–14 mm vs. 10–11 mm). *Monardella*

australis subsp. *gabrielensis* occurs west and northwest of Mount San Antonio (the highest peak in the San Gabriel Mountains at 3069 m), while *M. australis* subsp. *jokerstii* occurs south and east of it.

In the San Bernardino Mountains *Monardella australis* subsp. *australis* (Fig. 1A) and *M. linoides* A. Gray subsp. *erecta* (Abrams) Elvin & A. C. Sanders (Fig. 1F) appear to interbreed extensively, based on numerous putative hybrid specimens. This pattern continues in the San Gabriel Mountains, where there are a number of specimens that exhibit intermediate states in pubescence, leaf and bract size and shape, and general habit between *M. australis* subsp. *gabrielensis* and *M. linoides* subsp. *erecta* specimens (e.g., *O. Mistretta 1886* [RSA], *R. G. Swinney 5589* [RSA, UCR], *R. G. Swinney 5646* [RSA, UCR], *Swinney 5656* [RSA, UCR]).

Paratypes. U.S.A. **California:** Los Angeles Co., *R. Bacigalupi 6419* (JEPS not seen, LA), *D. Bramlet 4959* (GH, OBI), *J. A. Ewan 8417* (LA), Sep. 1917, *F. Grinnell s.n.* (RSA-401600), 29 Aug. 1917, *s.n.* (RSA-401603), 29 Aug. 1917, *s.n.* (POM-8130), 23 Aug. 1893, *H. E. Hasse s.n.* (NY), *O. Mistretta 1824* (RSA), *1924* (RSA), *F. W. Peirson 1070* (RSA), *T. S. Ross 5594* (RSA, UC not seen), *5779* (RSA, UC not seen), *R. G. Swinney 9071* (RSA, UCR), *9210* (UCR, VFWO), *R. F. Thorne 38267* (RSA), *L. C. Wheeler 10058* (RSA), *10308* (RSA), 23 July 1968, *s.n.* (RSA-638957), 7 Aug. 1968, *s.n.* (RSA-609405).

1d. Monardella australis subsp. **jokerstii** Elvin & A. C. Sanders, Novon 19: 323–324, fig 4. 2009. TYPE: U.S.A. California: San Bernardino Co., S face of Cucamonga Peak, just W of Day Creek, 25 Aug. 2006, *M. A. Elvin & K. VinZant 5085* (holotype, UCSB; isotypes, ARIZ, BRY, CAS, CHSC, F, GH, IRVC, JEPS, K, MO, NY, OBI, RSA, SBBG, SD, UCR, US). Figure 1D.

Monardella australis subsp. *jokerstii* occurs in colluvium on steep scree or talus slopes or stony benches on canyon bottoms in montane forest and chaparral at (160)1350–1750 m in elevation. *Monardella australis* subsp. *jokerstii* is endemic to the San Gabriel Mountains in San Bernardino County, California, where it occurs in the vicinity of Cucamonga Peak (Mount San Antonio) and the western portion of Lytle Creek. It is distinguished from the other *M. australis* subspecies by its serrate leaves and branching inflorescence.

1e. Monardella australis subsp. **occidentalis** Elvin, R. A. Burgess & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: Ventura Co., Pine Mountain Ridge, steep slope with clay loam soils derived from a sandstone base in a rocky/scree colluvium matrix, 2130 m, 20 June 2014, *R. A. Burgess, M. A. Elvin & L. Simpson 9700* (holotype, UCR; isotype, CAS, K, LA, MO, OBI, SBBG, VFWO). Figures 1E, 3.

Diagnosis. The new subspecies is similar to *Monardella australis* Abrams subsp. *australis*, but differs in having wider leaves (4–11 mm vs. 2.5–5 mm in subsp. *australis*), shorter bracts (7–12 mm vs. 12–18 mm), shorter calyces (7–8.5 mm vs. 8.5–10 mm), and short nonglandular stem trichomes 0.1–0.2 mm long.

Caespitose perennials to subshrubs, 8–22 cm tall, tufted to matted; rhizomatous; stems visibly woody at base, pubescence dense, with 3 types of stem trichomes, (1) glandular, 0.02–0.04 mm, (2) non-glandular, 0.1–0.2 mm, and (3) non-glandular, 0.3–0.6 mm. Leaves 11–17 mm × 4–11 mm, elliptic to ovate, sessile, pale or grayish green; with 2 types of trichomes on adaxial blades, (1) glandular, 0.02–0.04 mm (dense), and (2) non-glandular, 0.4–0.6 mm; with 3 types of trichomes on abaxial blade surfaces, (1) glandular, 0.02–0.04 mm (dense), (2) non-glandular, 0.1–0.2 mm, and (3) non-glandular, 0.4–0.6 mm; leaves subsessile to decurrent, bases acute to obtuse (truncate) decurrent, apices widely acute to obtuse. Inflorescence a terminal glomerule on primary stems, solitary; glomerules 14–19 mm wide; glomerule bracts 7–12 mm × (3.5)4–5.5 mm, stramineous to purple, widely elliptic, greater than or equaling the calyces. Flowers with the calyx 7–8.5 mm, purple; calyx with 3 types of trichomes, (1) glandular, 0.2 mm, (2) glandular, 0.4 mm (sparse), and (3) non-glandular, 0.3–0.6 mm; corolla 13–16 mm, white to cream, occasionally with purple markings that make it appear pale lavender in general color; stigma 16–19 mm, exserted; stamens 15–18 mm, exserted. Fruit a nutlet, tan to light brown, mottled dark brown, oblong, 2.25–2.35 × 0.8–0.9 mm.

Distribution and habitat. *Monardella australis* subsp. *occidentalis* is an extremely rare plant with only one known extant occurrence, which is in Ventura County. It has been collected in the Western Transverse Ranges and the southeastern edge of the Outer South Coast Ranges in Santa Barbara County. The plants in Ventura County were collected on Pine Mountain Ridge, south of Mount Piños and Frazier Mountain. The plants in Santa Barbara County were collected in the San Rafael Mountains near Big Pine [Mountain]. Specimens have been taken from dry, exposed rocky slopes at elevations between 1890 m and 2433 m. It occurs as an understory species in mixed conifer woodlands and montane chaparral associated with Pinaceae such as *Abies concolor* (Gordon & Glend.) Hildebr., *Pinus jeffreyi*, *P. lambertiana*, *P. ponderosa* P. Lawson & C. Lawson;

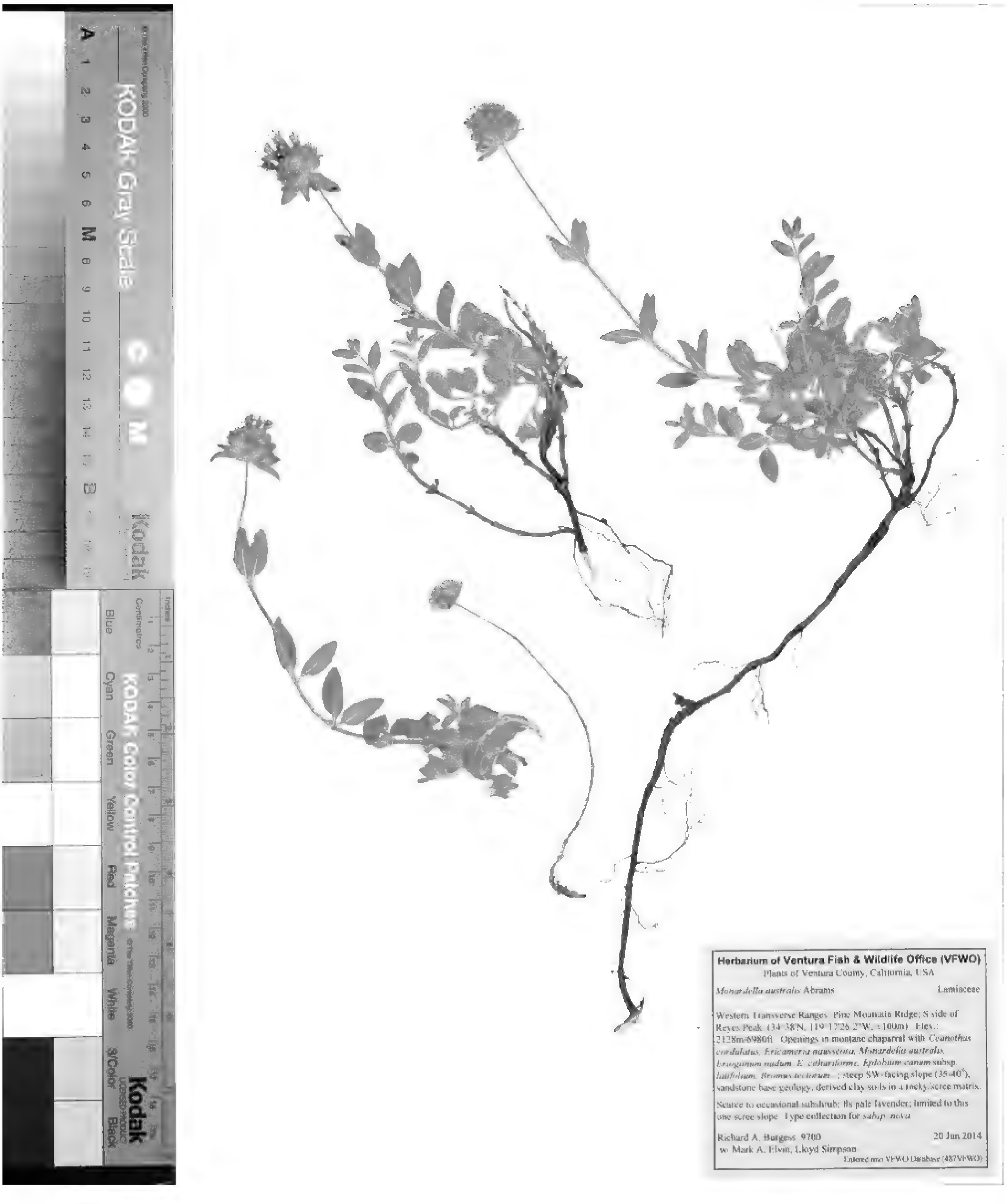


Figure 3. *Monardella australis* Abrams subsp. *occidentalis* Elvin, R. A. Burgess & A. C. Sanders. Holotype, *R. A. Burgess, M. A. Elvin & L. Simpson 9700* (UCR).

Asteraceae such as *Ericameria nauseosa* var. *mohavensis* (Greene) G. L. Nesom & G. I. Baird; and Rhamnaceae such as *Ceanothus cordulatus* Kellogg and *Frangula californica* (Eschsch.) A. Gray subsp. *tomentella* (Benth.) Kartesz & Gandhi. Associated herbaceous and suffruticose perennials of the understory include Asteraceae such as *Chaenactis santolinoides* Greene, Onagraceae such as *Epilobium canum* (Greene) P. H. Raven subsp. *latifolium* (Hook.) P. H. Raven, and Polemoniaceae such as *Eriastrum densifolium* (Benth.) H. Mason subsp. a*ustromontanum* (T. T. Craig) H. Mason. *Monardella australis* subsp. *occidentalis* occurs in colluvium on a sandy clay loam soil derived from weathered sandstone, sandy loam, and very gravelly sandy loam. This edaphic condition is unique within *M. australis* because all other *M.*

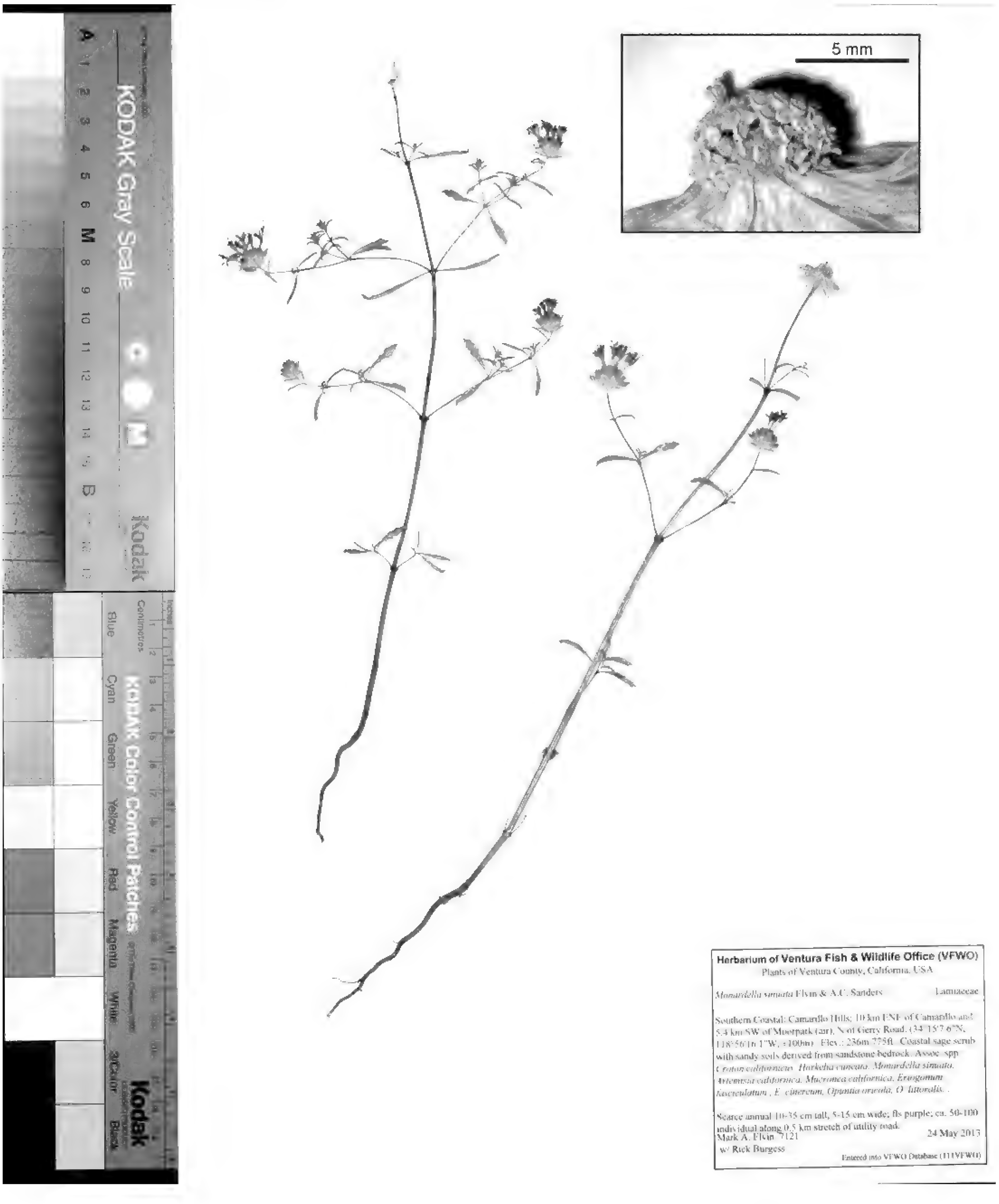


Figure 4. *Monardella sinuata* Elvin & A. C. Sanders subsp. *gerryi* Elvin, A. C. Sanders & R. A. Burgess. Holotype, *M. A. Elvin & R. A. Burgess 7121* (UCR), with pedicel and cuplike structure in inset box at top right.

australis subspecies occur on soils derived from granite.

IUCN Red List category. *Monardella australis* subsp. *occidentalis* appears to be exceedingly rare and has an extremely limited distribution. There have been only five collections, one from Big Pine [Mountain] in the San Rafael Mountains in Santa Barbara County and four from Pine Mountain Ridge in Ventura County, all from the same site. These two areas are adjacent mountain islands less than 35 km apart. With all known collections from only two sites on adjacent mountains, we estimate the known AOO to be less than 2 km^2, with 1 km^2 for each occurrence. Because there have been no other *M. australis* subsp. *occidentalis* collections, the EOO is likely to be small, and we estimate it to be approximately 27 km^2, using

a minimum convex polygon encompassing the two occurrences, but only 2 km², using the occupied 1 km² grid method. Much of the area between these two occurrences (and on the two mountains) consists of areas below the conifer forests that do not appear to be suitable habitat. Given its extremely limited distribution, the separation of the two occurrences from each other, and uncertainty regarding climate change, *M. australis* subsp. *occidentalis* is assessed here as CR, or Critically Endangered (CR B2ab[i,ii,iii,v]c[iii,iv]), according to IUCN (2001) categories and criteria. Of note is that much of this area does not have easy access, and the region has not been intensely botanized; therefore, more occurrences may be discovered with intensive fieldwork.

Phenology. Plants of *Monardella australis* subsp. *occidentalis* have been documented in flower between early June and early July, but it likely blooms later into the summer and possibly into early fall.

Etymology. The Latin epithet *occidentalis* refers to the distribution of this subspecies in relation to the other *M. australis* subspecies; it is the westernmost, or occidental, of the five subspecies.

Taxonomic affinities. *Monardella australis* subsp. *occidentalis* differs from *M. australis* subsp. *australis* in its wider leaves (4–11 mm vs. 2.5–5 mm in subspecies *australis*), shorter bracts (7–12 mm vs. 12–18 mm), and shorter calyces (7–8.5 mm vs. 8.5–10 mm). It is distinguished by its short (0.1–0.2 mm) non-glandular trichomes on the stems (lacking in subspecies *australis*) and by its short (0.1–0.2 mm) non-glandular trichomes on the abaxial leaf surfaces. *Monardella australis* subsp. *occidentalis* lacks the minute (0.04–0.06 mm) glandular calyx trichomes found in subspecies *australis*. Rather, the new subspecies has short (0.2–0.4 mm) glandular calyx trichomes that are not found in subspecies *australis*, and it has longer corollas (13–16 mm vs. 10–13 mm).

Monardella australis subsp. *occidentalis* differs from *M. australis* subsp. *gabrielensis* in its wider leaf blades (4–11 mm vs. [2.2]3.5–5[6] mm in subspecies *gabrielensis*) and its wider glomerule bracts ([3.5]4–5.5 mm versus 2–4.5 mm), which exceed or equal the calyces versus being less than calyx lengths. It is distinguished by the short (0.1–0.2 mm) non-glandular trichomes on the stems (lacking in subspecies *gabrielensis*) and by the short (0.1–0.2 mm) non-glandular trichomes on abaxial leaf surfaces (lacking in subspecies *gabrielensis*). It lacks short (0.1–0.2 mm) glandular trichomes on the calyces (that are present in subspecies *gabrielensis*) and has longer (0.3–0.6 mm) non-glandular trichomes on the calyces (lacking in subspecies *gabrielensis*).

Monardella australis subsp. *occidentalis* differs from *M. australis* subsp. *cinerea* in its larger leaves (11–17 × 4–11 mm vs. 5–10 × 2–5 mm in subspecies *cinerea*), its green vestiture (vs. cinerous), and its slightly taller plants (8–22 cm vs. 3–15 cm). It has two types of glandular trichomes, (1) 0.2 mm and (2) 0.4 mm (sparse) on the calyces that are both longer than the short glandular calyx trichomes (0.1–0.2 mm) observed in subspecies *cinerea*. *Monardella australis* subsp. *occidentalis* has corollas that are longer (13–16 mm vs. 9–11 mm for subspecies *cinerea*).

Monardella australis subsp. *occidentalis* is distinguished from *M. australis* subsp. *jokerstii* by its leaf blade margins that are more or less entire (vs. serrate in subspecies *jokerstii*), by its inflorescences as solitary glomerules (vs. one to five glomerules in an open compound cyme), by its longer corollas 13–16 mm (vs. 10–11 mm), and by its smaller habit (8–22 cm vs. 5–35 cm).

Monardella linoides subsp. *oblonga* (Greene) Abrams occurs in the general region of Pine Mountain Ridge (to the north and east). A *Monardella* specimen collected nearby on Sewart Mountain (*Burgess 9433* [VFWO]) represents a putative introgressant specimen between *M. australis* subsp. *occidentalis* and *M. linoides* subsp. *oblonga*. Some introgression between these two taxa is expected given the observed introgression between *M. australis* s.l. and *M. linoides* s.l. in the San Bernardino, San Jacinto, and San Gabriel mountains in areas where those species occur in close proximity (Elvin & Sanders, 2009).

Paratypes. U.S.A. **California:** Santa Barbara Co., *R. Hoffmann 644* (CAS, SBBG); Ventura Co., *R. A. Burgess 8921* (PH, UCR), *9479* (CIC, GH, JEPS, NDG, NY, RM, US, WTU), *E. R. Chandler 3124* (SBBG), 8 June 1966, *s.n.* (SBBG-84125), *M. A. Elvin 7447* (MSC, OSC, UTC, VFWO).

2. Monardella sinuata Elvin & A. C. Sanders, Novon 19: 338–340, fig. 10. 2009. TYPE: U.S.A. California: Santa Barbara Co., Burton Mesa, W of Santa Lucia Canyon, N of Lakes Canyon, 15 May 2006, *M. A. Elvin, L. Lum & L. Ballard 4904* (holotype, UCSB; isotypes, IRVC, JEPS, MO, RSA, UCR, US).

Monardella sinuata occurs in sand dunes and openings in coastal scrub and oak woodlands at elevations below 300 m. *Monardella sinuata* occurs from Marin County in northern California to Ventura County in southern California. It is distinguished by its undulating leaf margins and annular habit.

2a. Monardella sinuata subsp. **sinuata**.

Monardella sinuata subsp. *sinuata* occurs on sandy soils in relictual dunes and sandy areas in coastal scrub and oak woodland habitats at elevations below 300 m. *Monardella sinuata* subsp. *sinuata* is found in coastal areas from Morro Bay in San Luis Obispo County south to sand dunes in the Purisima Hills in Santa Barbara County, California. It is distinguished from *M. sinuata* subsp. *nigrescens* Elvin & A. C. Sanders by its taller, yet more gracile, habit and by lacking the darkened stems and bract veins and apices of subspecies *nigrescens*.

2b. Monardella sinuata subsp. **gerryi** Elvin, A. C. Sanders & R. A. Burgess, subsp. nov. TYPE: U.S.A. California: Ventura Co., Camarillo Hills, sandstone soils, 236 m, 24 May 2013, *M. A. Elvin & R. A. Burgess 7121* (holotype, UCR; isotypes, JEPS, MO, RSA, US, VFWO). Figure 4.

Diagnosis. The new subspecies is similar to *Monardella sinuata* Elvin & A. C. Sanders subsp. *sinuata*, but differs in having the calyx shorter (5.5–6 mm vs. 7–8 mm in subspecies *sinuata*), glandular calyx trichomes 0.02–0.04 mm long (lacking in subspecies *sinuata*), sparse conoideus glands along the stems (lacking in subspecies. *sinuata*), and longer nutlets (1.5–1.6 mm vs. ca. 1.1 mm).

Annual, erect, gracile, 7–30(43) cm tall, simple to moderately branched, ± glabrous to very sparsely pubescent, stem with 1 type of trichome, non-glandular, 0.1–0.2 mm, retrorse, stems stramineous to tan, with conoideus glands sparsely present. Leaves 10–35 × 2–6 mm, with length-to-width (L:W) ratios of 5–7:1, blades narrowly elliptic, ± glabrous to very sparsely pubescent, with 1 type of trichome on adaxial surface, non-glandular, 0.1–0.2 mm (rare), with 1 type of trichome on abaxial surface, non-glandular, 0.1–0.2 mm (sparse), leaves subsessile to decurrent (rarely cuneate), margins generally slightly undulate, occasionally strongly undulate, bases acute, apices acute. Inflorescence solitary to an open compound cyme; flowers in terminal glomerules; glomerules 1 to 7 per plant, glomerules on main stem 10–17 mm wide, glomerules on axillary branches, 7–12 mm wide; glomerule bracts 7–9(12) × 3.5–6 mm; with 1 type of trichome, non-glandular, 0.1–0.2 mm, and with 2 types of cilia, (1) non-glandular, 0.1–0.2 mm and (2) non-glandular, 0.3–0.5 mm (sparse), bracts elliptic to widely lanceolate, veins green, ± translucent between veins, apices acute to acuminate, purple-tinged or not, less than or equaling calyces. Flowers with pedicels 1–1.5 mm; calyx 5.5–6 mm, rapidly caducous after anthesis, ± glabrous to very sparsely pubescent; with 2 types of trichomes, (1) glandular, 0.02–0.04 mm, and (2) non-glandular, 0.3–0.6 mm; calyx teeth with 1 type of trichome, non-glandular, 0.3–0.6 mm; corolla 11–14 mm, upper 2 corolla lobes gland-tipped, purple; stigma 13–17 mm, exserted; stamens 13–17 mm, exserted. Fruit a nutlet, light brown with dark brown spots and streaks, oblong, 1.5–1.6 × 0.8 mm.

Distribution and habitat. *Monardella sinuata* subsp. *gerryi* is endemic to the Las Posas and Camarillo hills west of the Santa Monica Mountains and southeast of the Santa Clara River in Ventura County, California. It occurs at elevations between 150 m and 243 m in openings in coastal sage scrub. Associated species in the microhabitats include a number of unique and uncommon taxa typically found in coastal maritime scrub or other arid environments: Euphorbiaceae such as *Croton californicus* Müll. Arg., *Euphorbia polycarpa* Benth., and *Stillingia linearifolia* S. Watson; Polygonaceae such as *Mucronea californica* Benth.; Polemoniaceae such as *Eriastrum densifolium* (Benth.) H. Mason subsp. *elongatum* (Benth.) H. Mason; and Rosaceae such as *Horkelia cuneata* Lindl. subsp. *puberula* (Rydb.) D. D. Keck. Other common associates of the dominant plant community of the area, coastal sage scrub, include Asteraceae such as *Artemisia californica* Less., Fabaceae such as *Acmispon glaber* (Vogel) Brouillet, Lamiaceae such as *Salvia mellifera* Greene, and Polygonaceae such as *Eriogonum fasciculatum* Benth. *Monardella sinuata* subsp. *gerryi* occurs in sandy soils in the Las Posas Formation of Pleistocene Age. The soils in this unit are derived from weakly consolidated sandstone, with some gravelly sand units, and are highly susceptible to landsliding (Tan et al., 2004).

IUCN Red List category. *Monardella sinuata* subsp. *gerryi* is exceedingly rare and has only been collected three times since botanists started to document the flora of southern California in the 1800s. Currently, *M. sinuata* subsp. *gerryi* is known only from one small extant occurrence in a remnant patch of fragmented habitat in the Las Posas and Camarillo hills. Of the three *M. sinuata* subsp. *gerryi* collections, two were made over 40 years ago and are considered to be extirpated. We estimate that the Las Posas and Camarillo hills at one time may have supported up to 15.64 km^2 of suitable habitat before modern human habitation in the area. The Las Posas and Camarillo hills have experienced considerable residential and agricultural development, particularly in the last 10 to 20 years, which has resulted in a considerable loss of habitat and increased fragmen-

tation of the area. We estimate that currently there may be up to 1.84 km² of suitable habitat remaining for this species, all of which is either degraded or extremely fragmented. With only one known extant occurrence, we estimate the known AOO to be less than 1 km² and the EOO to also be less than 1 km². It should be noted that there are still some small pockets of habitat within the Las Posas and Camarillo hills that could harbor additional plants; however, we do not expect this subspecies to occur outside of the Las Posas or Camarillo hills. The Conejo Mountains, located a short distance to the south on the other side of the Simi-Santa Rosa fault zone and the Santa Rosa Valley, were formed from a different geological process and are composed of Conejo Volcanics, which weather to clay soils. The Conejo Mountains support a very different flora with a number of its own rare, narrow endemic plants, for example, Crassulaceae such as *Dudleya parva* Rose & Davidson and *D. verityi* K. M. Nakai and Polygonaceae such as *Eriogonum crocatum* Davidson. Given the uncertainty regarding climate change, its extremely limited extant distribution, and the fragmentation and degradation of the remaining potential habitat, *M. sinuata* subsp. *gerryi* is assessed here as CR, or Critically Endangered (CR B1ab[i,ii,iii,iv,v]-c[I,ii,iii,iv]), according to IUCN (2001) categories and criteria. Because of this subspecies' extremely limited distribution (with only one known extant occurrence), the extreme fragmentation of and disturbance to its habitat, and increasing adverse effects from development, it may become extinct in the near future.

Phenology. Plants of *Monardella sinuata* subsp. *gerryi* have been documented as flowering between April and June.

Etymology. The Latin epithet *gerryi* refers to Will Gerry, who owns the property that contains this plant, allowed us access, and directed us to the place with suitable habitat where the *Monardella* plants grow. Of note is that he is a descendant of Elbridge Gerry, a founding father of the United States and a signer of the Declaration of Independence and Articles of Confederation.

Taxonomic affinities. *Monardella sinuata* subsp. *gerryi* is distinguished from *M. sinuata* subsp. *sinuata* in having narrower leaves (2–6 mm vs. [3]4–10 mm in subspecies *sinuata*), leaves with larger L:W ratios (5–7:1 vs. 3–6:1), and an almost complete lack pubescence on the adaxial leaf blade surfaces. Its primary glomerules are smaller (10–17 mm vs. 10–35 mm), its bracts are narrower (3.5–6 mm vs. 3–12 mm) and do not exceed the calyces (vs. bracts exceeding the calyces), its pedicels are longer (1–1.5 mm vs. 0.5–1 mm), its calyces are shorter (5.5–6 mm vs. 7–8 mm), it has minute glandular trichomes (0.02–0.04 mm) on the calyces (lacking in subspecies *sinuata*), and its corollas are shorter (11–14 mm vs. 13–16 mm). There are conoideus glands sparsely spread along the stems of *M. sinuata* subsp. *gerryi*, and its nutlets are longer (1.6 mm vs. 1.1 mm).

Monardella sinuata subsp. *gerryi* is distinguished from *M. sinuata* subsp. *nigrescens* in that its leaves are narrower (2–6 mm vs. 4–10 mm in subspecies *nigrescens*), and it has larger leaf L:W ratios (5–7:1 vs. 3–6:1). *Monardella sinuata* subsp. *gerryi* almost completely lacks pubescence on the adaxial blade surface of the leaves, but very rarely it contains 1 type of trichome here, non-glandular, 0.1–0.2 mm (vs. 2 types of trichomes, [1] non-glandular, 0.1–0.2, and [2] non-glandular, 0.3–0.5 mm [very sparse]). Its bracts are shorter (7–9[12] mm vs. 9–16 mm), narrower (3.5–6 mm vs. 6–12 mm), and do not exceed the calyces (vs. the bracts exceeding the calyces). Its primary glomerules are smaller (10–17 mm vs. 10–35 mm wide). Its glomerule bracts bear minute non-glandular trichomes (0.1–0.2 mm; lacking in subspecies *nigrescens*) and lack the long, non-glandular trichomes (0.6–1.2 mm) present in subspecies *nigrescens*. The pedicels of *M. sinuata* subsp. *gerryi* are shorter (1–1.5 mm vs. 2–2.5 mm), its calyces are shorter (5.5–6 mm vs. 7–9 mm) and bear very minute glandular trichomes (0.02–0.04 mm; lacking in subspecies *nigrescens*) and lack the long non-glandular trichomes (0.6–1.1 mm) present in subspecies *nigrescens*. For *M. sinuata* subsp. *gerryi*, its corollas are shorter (11–14 mm vs. 14–16 mm). There are scattered conoideus glands along the stems of *M. sinuata* subsp. *gerryi* (lacking in subspecies *nigrescens*), and its nutlets are longer (1.6 mm vs. 1.1 mm).

The rapid post-anthesal caducous calyces also distinguish *Monardella sinuata* subsp. *gerryi* from subspecies *nigrescens* and subspecies *sinuata*. The calyces on the primary glomerules on *M. sinuata* subsp. *gerryi* begin dropping off while the axillary glomerules are still flowering. This rapid deciduousness has not been observed on any specimens of subspecies *nigrescens*. While the calyces of subspecies *sinuata* are slightly caducous, they do not drop off as readily or to the magnitude observed in subspecies *gerryi*. A cuplike structure remains and is evident on the pedicels of subspecies *gerryi* after the calyces have abscised. These cuplike structures have been observed in subspecies *sinuata* but not in subspecies *nigrescens*.

Monardella sinuata subsp. *gerryi* is geographically separated from the other two subspecies by the Santa Ynez Mountains of the Transverse Ranges. There are no known *M. sinuata* s.l. collections in any areas in the intervening 125+ km between the Las Posas and Camarillo hills and the southeast Purisima Hills. There is little or no suitable habitat in this intervening region. There are no intermediate specimens between *M. sinuata* subsp. *sinuata* and *M. sinuata* subsp. *gerryi*. This geographic isolation would appear to be a significant barrier to gene flow that may warrant recognition of *M. sinuata* subsp. *gerryi* at the specific rank. We considered recognizing *M. sinuata* subsp. *gerryi* at the rank of species because of its significant geographic isolation and other distinct morphological differences from the other *M. sinuata* subspecies; however, erring on the side of caution and recognizing their similarities, we recognize the taxon as a subspecies of *M. sinuata*. We recommend a closer look be taken at this taxon and at any potential gene flow that may or may not be occurring to determine if it warrants recognition as a species.

Paratypes. U.S.A. **California:** Ventura Co., *M. A. Elvin 7131* (NY, SBBG), *N. French 311* (UC, USFS [2]), *D. F. Howe 4924* (SD, SDSU not seen).

2c. Monardella sinuata subsp. **nigrescens** Elvin & A. C. Sanders, Novon 19(3): 340–342, fig. 11. 2009. TYPE: U.S.A. California: Marin Co., Point Reyes Peninsula, 12.5 mi. from Inverness, sandy knoll on crest of ridge, 18 May 1938, *A. Carter 1417* (holotype, GH; isotypes, DS, LA, RM, RSA not seen, UCR, UTC, WTU).

Monardella sinuata subsp. *nigrescens* occurs on sandy soils in coastal strand, dune scrub, sagebrush scrub, coastal chaparral, and oak woodland at elevations below 300 m. *Monardella sinuata* subsp. *nigrescens* occurs in coastal areas from Monterey Bay in Monterey County north to Point Reyes in Marin County, California. It is distinguished from the other two subspecies by its stout habit and its darkened stems and bract veins and apices.

3. Monardella purpurea Howell, Fl. N.W. Amer. 1: 550. 1901. *Madronella purpurea* (Howell) A. Nelson, Bot. Gaz. 52: 271. 1911. TYPE: U.S.A. Oregon: Josephine Co., "In dry rocky places, eastern base of the Coast Mountains, southwest Oregon," near Waldo, 13 June 1884, *J. T. Howell s.n.* (lectotype, designated here, ORE-96231; isolectotypes, ORE-96230, PH-1113651, PH-742185, US-43116, VT-s.n., WTU-25006).

Discussion. Howell (1901) did not give a specific location for the type, cite any specimens, or mention any herbaria in which specimens might reside in the protologue for *Monardella purpurea* Howell. He simply stated that it was "in dry rocky places, eastern base of the Coast Mountains southwestern Oregon." For many years, botanists have indicated that an unnumbered Howell collection from 13 June 1884 seems a likely collection from which Howell might have based his description of *M. purpurea* (e.g., Epling, 1925; Jepson, 1943). There are six known duplicates of this unnumbered Howell collection from 13 June 1884 "near Waldo," and they are consistent with the description in his protologue. Of these six duplicates, two of these reside at ORE, ORE-96230 and ORE-96231. Both are representative of *M. purpurea*, and sheet ORE-96231 has "*purpurea* Howell" and "Type Specimen" handwritten on the label. Stephen Meyers, at OSC, confirmed that the writing is in Howell's own hand (pers. comm., 2014). We hereby designate specimen ORE-96231 as the lectotype. Considering the remaining sheets to constitute a single gathering, we list the other five duplicates as isolectotypes accordingly.

Monardella purpurea s.l. occurs in rock outcrops or on rocky slopes, generally in soils associated with or derived from serpentine. It is found in coastal scrub, woodland, or montane forest in coastal areas and coastal mountain ranges from central California (Marin County) north to southwestern Oregon (Douglas County).

3a. Monardella purpurea subsp. **purpurea**.

Monardella purpurea subsp. *purpurea* occurs in rock outcrops or on rocky slopes, generally in soils associated with or derived from serpentine. It is found in coastal scrub, woodland, or montane forest in coastal areas and coastal mountain ranges from central California (Sonoma County) north to southwestern Oregon (Douglas County). *Monardella purpurea* subsp. *purpurea* is distinguished by its large leaves (12–30 × 5–10 mm), large bracts (9–14 × 5–7 mm) with a purple tinge or color, purple stems, and is essentially glabrous with a very sparse pubescence occasionally found on stems, bracts, and calyces.

3b. Monardella purpurea subsp. **neglecta** (Greene) Elvin & A. C. Sanders, comb. et stat. nov. Basionym: *Monardella neglecta* Greene, Pittonia 5: 82. 1902. *Madronella neglecta* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella odoratissima* Benth. var. *neglecta* (Greene) Jeps., Man. Fl. Pl. Calif. 882. 1925. *Monardella villosa* Benth. subsp. *neglecta*

(Greene) Epling, Ann. Missouri Bot. Gard. 12: 52. 1925. *Monardella villosa* Benth. var. *neglecta* (Greene) Jeps., Fl. Calif. 3: 435. 1943. TYPE: U.S.A. California: Marin Co. [Mt. Tamalpais,] 1875, *Vasey s.n.* (lectotype, designated by Epling [1925: 52–53], US-45760 digital image, isolectotypes, NDG-44419B, US-45761 digital image).

Discussion. The status of the small, essentially glabrous plants with small, entire to serrulate-toothed leaves from serpentine soils in Marin County, California, has been debated since E. L. Greene first described them as *Monardella neglecta* (Greene, 1902: 82). They have been recognized either as a subordinate taxon of *M. villosa* (Epling, 1925; Jepson, 1943; Abrams, 1951; Munz, 1959) or *M. odoratissima* (Jepson, 1925) or independently at species rank (Greene, 1902; Howell, 1949, 1970) for almost all except the last 21 of the last 111 years. We concur with Greene (1902: 82) that "this neat and elegant" plant is a "most distinct little *Monardella*." Based on the similar morphological characters and the putative introgression of this taxon with *M. purpurea* in Sonoma County, we treat it here as a subspecies: *M. purpurea* subsp. *neglecta*. It corresponds well morphologically with *M. purpurea* in that they both are very nearly glabrous plants—including the stems, bracts, calyces, and leaves—and both have a predominantly purple vestiture. While there are putative introgressant specimens between *M. purpurea* subsp. *neglecta* and *M. villosa* s.l. (*J. and B. Guggolz 1242* [CHSC, JEPS]; 27 May 1902, *K. Brandegee s.n.* [UC-185721], partial sheet, marked as b.), the taxon does not fit in well with *M. villosa* because it lacks the abundant villous pubescence and robust habit of that species. In contrast, plants of *M. purpurea* subsp. *neglecta* are distinctive in their nearly glabrous surfaces, small stature, and purple-tinged herbage. *Monardella purpurea* subsp. *neglecta* differs from *M. purpurea* subsp. *purpurea* in several characters of the leaves, glomerules and their associated bracts, and several pubescence characters. In *M. purpurea* subsp. *neglecta*, the leaf blades are ovate, with serrulate margins, and sized as 9–15 × 3.5–7 mm (vs. blades oblong, entire, 12–30 × 5–10 mm in subspecies *purpurea*), the glomerules are 12–18 mm wide (vs. 15–25 wide mm in subspecies *purpurea*), and the glomerule bracts are somewhat shorter (7–8 mm vs. 9–14 mm). *Monardella purpurea* subsp. *neglecta* contains minute non-glandular trichomes (0.04–0.06 mm) on the stem (vs. minute non-glandular trichomes 0.06–0.1 mm) and non-glandular calyx teeth trichomes (0.2–0.4 mm vs. 0.4–0.6 mm).

In the protologue for *Monardella neglecta*, Greene (1902) did not cite a type specimen. He stated that *M. neglecta* "did not appear to have been collected except by G. R. Vasey in 1875, and Geo. W. Dunn in 1890. The special locality is, of course, unknown" (Greene, 1902: 82). These are presumably the specimens in the Greene Herbarium (NDG) at Notre Dame and in the U.S. National Herbarium (US). It cannot be determined for certain whether Greene saw the specimens at US because he did not annotate them, but we think it is likely. In his monograph of the genus *Monardella* (1925), Epling recognized *M. neglecta* as a subspecies of *M. villosa* and cited *G. R. Vasey s.n.* at US as the "Type" (lectotype). He erroneously listed its collection date as 1876, instead of 1875, in the specimens examined section. While discussing his decision for selecting the Vasey collection as the type, he had this to say about the two syntype collections:

> The specimen collected by Vasey on Mt. Tamalpais is cited with the description of *M. neglecta* Greene. In the Greene Herbarium a fragment of this plant is mounted on the same sheet with a specimen collected by G. W. Dunn in Marin Co., July 22, 1890. The latter collection is designated as the type in Greene's handwriting. Only a photograph of this sheet has been seen by the author (Epling, 1925: 52–53).

Epling listed the *Vasey s.n.* collection at GH as an isotype and the material residing at US as the "type." There are two duplicates of the Vasey *M. neglecta* collection at US (US-45760 and US-45761). Both specimens have "type" written on them in Epling's hand, indicating that he saw both specimens. He also annotated sheet US-45760 (1875, *Vassey s.n.*) with the following: "This sheet considered the type sheet by me." We therefore recognize this sheet as the lectotype. It has the best representative material of all of the syntype sheets, containing three whole plants that include rhizomes, roots, and glomerules with flowers; it has more duplicates; and it is more widely distributed. We recognize sheets US-45761 and NDG-44419B as isolectotypes.

Monardella purpurea subsp. *neglecta* occurs in rock outcrops and on rocky slopes associated with serpentine soils in coastal scrub. It occurs in Marin and Sonoma counties, California. It is distinguished from subspecies *purpurea* by its smaller leaves (9–15 × 3.5–7 mm vs. 12–30 × 5–10 mm), smaller bracts (7–8 × 4–6 mm vs. 9–14 × 5–7 mm), and serrulate leaves (vs. entire in subspecies *purpurea*).

Additional specimens examined. U.S.A. **California:** Marin Co., 22 July 1890, *Geo. W. Dunn s.n.* (syntype,

NDG-44419A); Tiburon Peninsula, *J. T. Howell 48866* (SBBG), *R. F. Hoover 9483* (OBI); Mt. Tamalpais, *A. Graff M-54* (CHSC), *C. V. Morton 2893* (US); Sonoma Co., Harrison Grade, *R. F. Hoover 9474* (OBI), Monte Rio, *R. F. Hoover 5915* (UC).

4. Monardella villosa Benth., Bot. Voy. Sulphur 42, pl. XXI. 1844. *Madronella villosa* (Benth.) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella villosa* Benth. subsp. *euvillosa* Epling, Ann. Missouri Bot. Gard. 12: 46, pl. 3, fig. 1. 1925, nom. illeg. TYPE: U.S.A. California: Bodegas, 1841, *R. B. Hinds s.n.* (holotype, K [barcode] 248497).

Discussion. *Monardella villosa* s.l. is a complex and widespread species that occurs from southern California (Santa Barbara County) to central Oregon (Douglas County), a distance of over 1000 km. Recent taxonomic work on *Monardella* revealed a number of issues concerning this species complex that had not been resolved previously. Foremost is that the plants currently treated under that name *M. villosa* subsp. *villosa* do not conform with the type of *M. villosa* subsp. *villosa*, and the name has apparently been misapplied to these plants by American botanists since 1925. This is further discussed below. There also appears to be incipient speciation on the numerous montane island ecosystems and on different local substrates—for example, serpentine and granite—throughout the range of *M. villosa* s.l.

4a. Monardella villosa subsp. **villosa** *Monardella franciscana* Elmer, Bot. Gaz. 41: 320. 1906, syn. nov. *Madronella franciscana* (Elmer) Elmer ex A. Heller, Muhlenbergia 2: 244. 1906. *Monardella villosa* Benth. var. *franciscana* (Elmer) Jeps., Man. Fl. Pl. Calif. 881. 1925. *Monardella villosa* Benth. subsp. *franciscana* (Elmer) Jokerst, Phytologia 72: 14. 1992. TYPE: U.S.A. California: San Mateo Co., San Pedro, July 1903, *A. D. E. Elmer 4766* (lectotype, designated by Epling [1925: 48], DS digital image; isolectotypes, CAS, MO digital image, NY digital image, UC not seen, US digital image).

When Elmer described *Monardella franciscana* in 1906, he did not designate which of the several duplicates of *Elmer 4766* was the holotype (Elmer, 1906) as he had done the previous year with *M. crispa* Elmer (Elmer, 1905). Epling (1925: 48, "type collection of *M. franciscana*, Type in DH") selected the specimen at DS as type in his monograph having seen specimens of *Elmer 4766* from MO, UC, and US. Because no type was designated in Elmer's 1905 protologue, all of the *Elmer 4766* specimens represent syntypes. Epling's later designation of *Elmer 4766* (DS) as the type, therefore, is recognized as the lectotype for this species.

Discussion. *Monardella villosa* subsp. *villosa* occurs in coastal areas of Marin, San Francisco, San Mateo, and Santa Cruz counties in California. It is noted for having an abundance of villous hairs 0.3–1 mm long on the stems, leaves, and calyces with leaves that are ovate to triangular and have an obtuse to truncate base.

The type specimens of *Monardella villosa* subsp. *franciscana* closely correspond to the type of *M. villosa* subsp. *villosa* and are essentially indistinguishable from Bentham's type for *M. villosa* subsp. *villosa*. Both collections share leaves that have widely obtuse bases that are cuneate to decurrent, are woolly on the abaxial blade surface, and contain an abundance of long, non-glandular trichomes (0.3–1 mm) on the stems, leaves, bracts, and calyces. Plants representing the type collection of *M. villosa* subsp. *franciscana* have bases that are slightly wider than those of the type of *M. villosa* subsp. *villosa*, but the range of variation for this character has almost complete overlap between the two collections. The bases of a few *M. villosa* subsp. *franciscana* leaves on the type sheets attain a wider angle than on *M. villosa* subsp. *villosa* and almost qualify as truncate. *Monardella villosa* subsp. *villosa* (sensu Elvin et al.) plants can best be described as a cline, regarding the leaf base and pubescence characters, that occurs from the south (type location for *M. franciscana*) to the north (type location for *M. villosa*). Plants of interior California and southwestern Oregon previously recognized as *M. villosa* subsp. *villosa* (e.g., Epling, 1925, Jokerst, 1993; Sanders et al., 2012) are not consistent with *M. villosa* subsp. *villosa* because they lack the dense, woolly pubescence on the abaxial leaf surface and the abundant long trichomes (0.3–1 mm) on the stems and, therefore, belong to a different taxon. The types for both *M. villosa* subsp. *villosa* and *M. villosa* subsp. *franciscana* occur in close proximity and the same ecological habitat. Because the type specimen of *M. villosa* was deposited in Europe, at Kew, American workers have had less access to it, which likely increased the misapplication of the name *M. villosa* subsp. *villosa*.

4b. Monardella villosa subsp. **obispoensis** (Hoover ex Jeps.) Jokerst, Phytologia 72: 14. 1992. Basionym: *Monardella villosa* Benth. var. *obispoensis* Hoover ex Jeps., Fl. Calif. 3: 435. 1943. *Monardella villosa* Benth. subsp. *obispoensis* (Hoover ex Jeps.) Jokerst, Phytologia 72(1): 14.

1992. TYPE: U.S.A. California: San Luis Obispo Co., near Cuesta Pass, 20 June 1908, *I. J. Condit s.n.* (holotype, JEPS-2652 digital image).

Monardella villosa subsp. *obispoensis* occurs in coastal areas and coastal mountains of California from Santa Barbara County to San Francisco County. It differs from all other *Monardella* taxa by the abundance of distinctive long, branched trichomes on its stems and leaves. With the exception of the zones of introgression between *M. villosa* subsp. *obispoensis* and each *M. villosa* subsp. *villosa* (in the north) and *M. hypoleuca* A. Gray subsp. *hypoleuca* (in the south), these branched trichomes have been found only on a few other specimens throughout the genus, and those specimens contained only a few.

4c. Monardella villosa subsp. **subserrata** (Greene) Epling, Ann. Missouri Bot. Gard. 12: 48. 1925. Basionym: *Monardella subserrata* Greene, Pittonia 5: 81. 1902. *Madronella subserrata* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella villosa* Benth. subsp. *subserrata* (Greene) Epling, Ann. Missouri Bot. Gard. 12: 48. 1925. *Monardella villosa* Benth. var. *subserrata* (Greene) Jeps., Fl. Calif. 3: 436. 1943. TYPE: U.S.A. California: Sonoma Co., June 1890, *G. W. Dunn s.n.* (holotype, NDG-44448, isotype, GH-s.n. [a photo of holotype sheet]).

Discussion. *Monardella* plants of interior areas and upland habitats throughout California and Oregon with an abundance of villous trichomes 0.3–1 mm have been identified as *M. villosa* subsp. *villosa* from Epling's 1925 monograph through the most recent floristic treatment (Sanders et al., 2012). Yet these plants do not fit within the circumscription of *M. villosa* subsp. *villosa* or conform to the type; therefore, another name must be applied to them. There are seven names available at the rank of subspecies within *M. villosa*: subspecies *villosa*, subspecies *franciscana*, subspecies *globosa* Greene, subspecies *neglecta*, subspecies *obispoensis*, subspecies *sheltonii* (Torr.) Epling, and subspecies *subserrata*. The epithets *villosa*, *franciscana*, *globosa*, *neglecta*, *obispoensis*, and *sheltonii* apply to other currently recognized taxa, most of which are discussed above. The only available name at this rank that applies to the plants in question is *M. villosa* subsp. *subserrata*. The description and type of *M. villosa* subsp. *subserrata* fit within the general characteristics and range of the long-pubescent, wide-leaved plants that occur in the coastal mountain ranges of central and northern California and into southern Oregon. These plants are hereby recognized as *M. villosa* subsp. *subserrata*.

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Chrysosplenium aureobracteatum (Saxifragaceae), a New Species from South Korea

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ABSTRACT. *Chrysosplenium aureobracteatum* Y. I. Kim & Y. D. Kim (Saxifragaceae) is described as a new species from Gangwon Province in central Korea. The new taxonomic entity, which was uncovered previously by molecular systematic study, resembles *C. sphaerospermum* Maxim. but is readily distinguishable by its golden bracteal leaves and by the long internodal distances of the distal leaf pairs on sterile branches such that leaf pairs are not clustered. Further, the two species exhibit clear differences in their seed coat morphology, which is considered an important diagnostic character in the genus.

Key words: *Chrysosplenium*, Gangwon, IUCN Red List, Korea, Saxifragaceae, seed morphology.

Chrysosplenium L. (Saxifragaceae) is a genus of perennial herbs, with 60 species distributed throughout temperate regions of the Northern Hemisphere, except for two disjunctive species in Chile (Hara, 1957; Ye & Zhang, 1994; Wakabayashi & Takahashi, 1999; Han et al., 2011). In the Northern Hemisphere, the greatest number of species is present in eastern Asia (Hara, 1957), where the genus is thought to have arisen, with several independent migration events from Asia to the New World (Soltis et al., 2001). The genus has been divided into two sections, *Chrysosplenium* sect. *Oppositifolia* Franch. and *Chrysosplenium* sect. *Alternifolia* Franch. (Franchet, 1890). *Chrysosplenium* has also been classified into 17 series based on multiple characters of the leaf, flower, capsule, and seed morphology (Hara, 1957). Soltis et al. (2001) concluded that Franchet's sections are monophyletic, while most of Hara's series are paraphyletic, with the exception of the two series *Chrysosplenium* ser. *Pilosa* Maxim. and *Chrysosplenium* ser. *Macrostemon* Hara.

Among the six species of *Chrysosplenium* ser. *Pilosa*, *C. pilosum* Maxim. comprises four varieties that represent several taxa that have been formerly recognized at either the species or varietal rank, and there is substantial variability in their morphology (Hara, 1957). Recently, Han et al. (2011) recognized two of the four varieties from *C. pilosum* as the species *C. sphaerospermum* Maxim. [= *C. pilosum* var. *fulvum* (A. Terracc.) H. Hara] and *C. valdepilosum* (Ohwi) S. H. Kang & J. W. Han [≡ *C. pilosum* var. *valdepilosum* Ohwi], with strong evidence provided by molecular phylogeny and morphological characteristics.

During the molecular phylogenetic study of *Chrysosplenium* ser. *Pilosa* in Korea, Kim and Kim (2011) found a novel lineage that is closely allied to *C. sphaerospermum*. Members constituting the lineage were found to be distributed in mountainous areas of central Korea, including the northeastern portion of Gyeonggi Province, and the northwestern part of Gangwon Province. Extensive field observation and detailed analysis of floral morphology and stem habit during the flowering and fruiting periods, as well as analysis of seed coat characters revealed by scanning electron microscopy (SEM), suggest that this new lineage merits distinction as a new species.

Chrysosplenium aureobracteatum Y. I. Kim & Y. D. Kim, sp. nov. TYPE: South Korea. Gangwon: along Gwangdeok Valley, Mt. Gwangdeok, Gwangdeok-ri, Sanae-myeon, Hwacheon-gun, N 38°05′49.2″, E 127°26′56.1″, 632 m, 16 Apr. 2009, *KYI-2009013* (holotype, HHU; isotypes, HHU, KB). Figures 1, 2C, D

Diagnosis. The new species is most similar to *Chrysosplenium sphaerospermum* Maxim., but can be distinguished by its golden-yellow bracteal leaves, its distal leaf pairs that are not clustered and are separated by long internodes on sterile branches, and its narrower seeds (ca. 0.56 mm vs. 0.64 mm in *C. sphaerospermum*) that have fewer ridges (ca. 16 vs. ca. 18), smaller tubercles (ca. 10 μm in diam. vs. ca. 15 μm), and few (usually one to 10) papillae to ca. 5 μm long on each tubercle.

Perennial herbs small, tender; roots fibrous; sterile branches well-developed, 2 to 4(5) arising from base of flowering stem, erect until fruiting, growing to equal or greater height than flowering stem at full anthesis, repent after fruiting, branching at axils, densely pilose. Leaves on sterile branch simple, opposite, without stipules; blades to 3 × 3 cm,

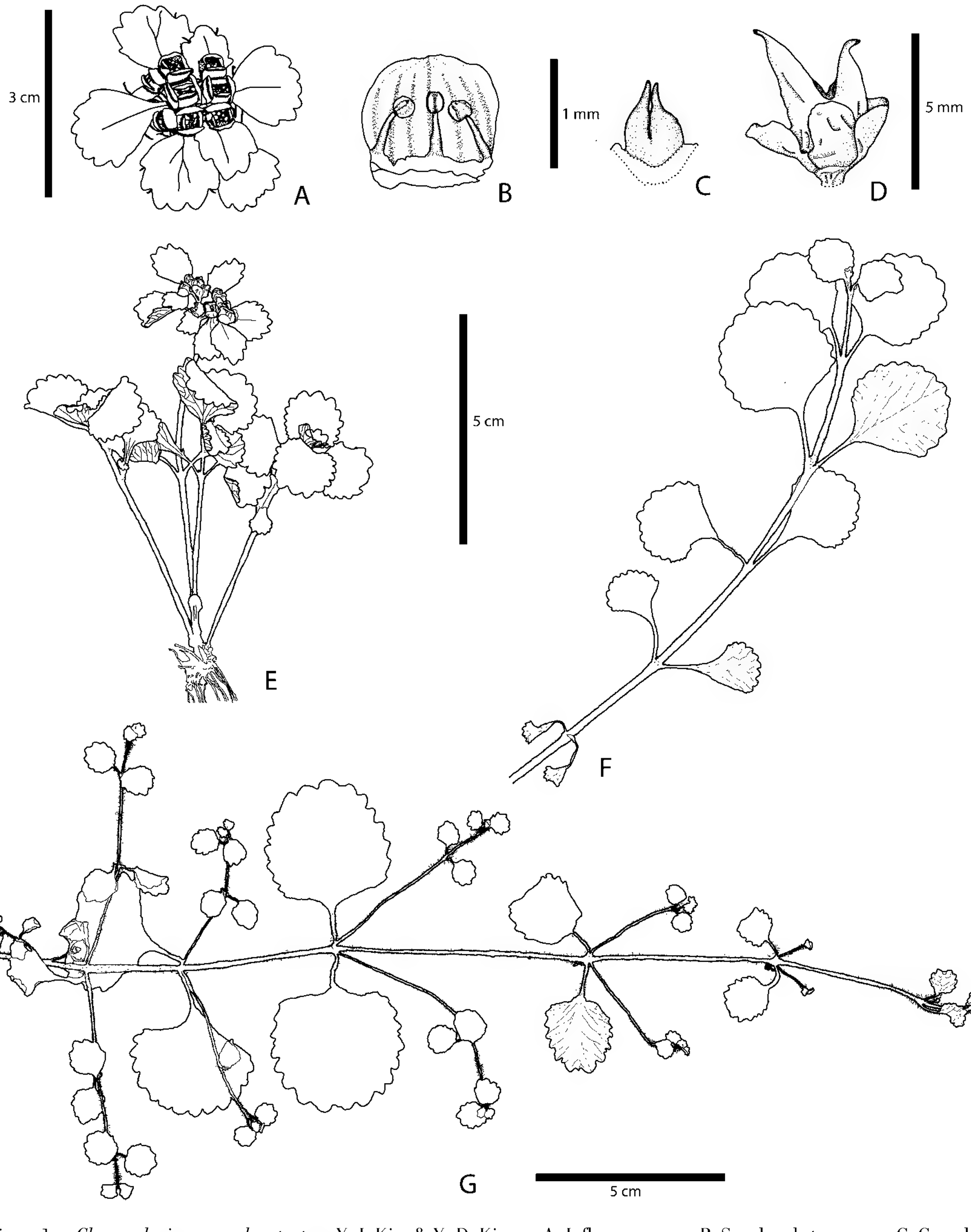


Figure 1. *Chrysosplenium aureobracteatum* Y. I. Kim & Y. D. Kim. —A. Inflorescence. —B. Sepal and stamens. —C. Carpels. —D. Capsule with persistent sepals. —E. Plant habit. —F. Sterile branch habit in fruiting stage. —G. Sterile branch habit after fruiting. A–C drawn from *KYI-2009013* (holotype, HHU); D and F drawn from *KYI-2009032* (HHU); E drawn from *KYI-2012007* (HHU); G drawn from *KYI-2013003* (HHU).

suborbicular or widely ovate (upper ones), flabellate (lower ones), apex rounded, base cuneate into petiole, margins crenate with 6 to 20 flat obscure teeth on each side; blades largest in the middle of sterile branches, becoming smaller toward apex and base, distal leaf pairs spaced at long internodal distances; adaxial leaf surface sparsely pilose, light green, abaxial leaf surface glabrous or pilose on veins, greenish gray; petioles (1–)3–8 mm, pilose. Flowering stems erect, 3.5–14 cm, densely pilose, reddish to purple in lower portion, light green above; leaves on flowering stems in 2 or 3(4) pairs, blades flabelliform,

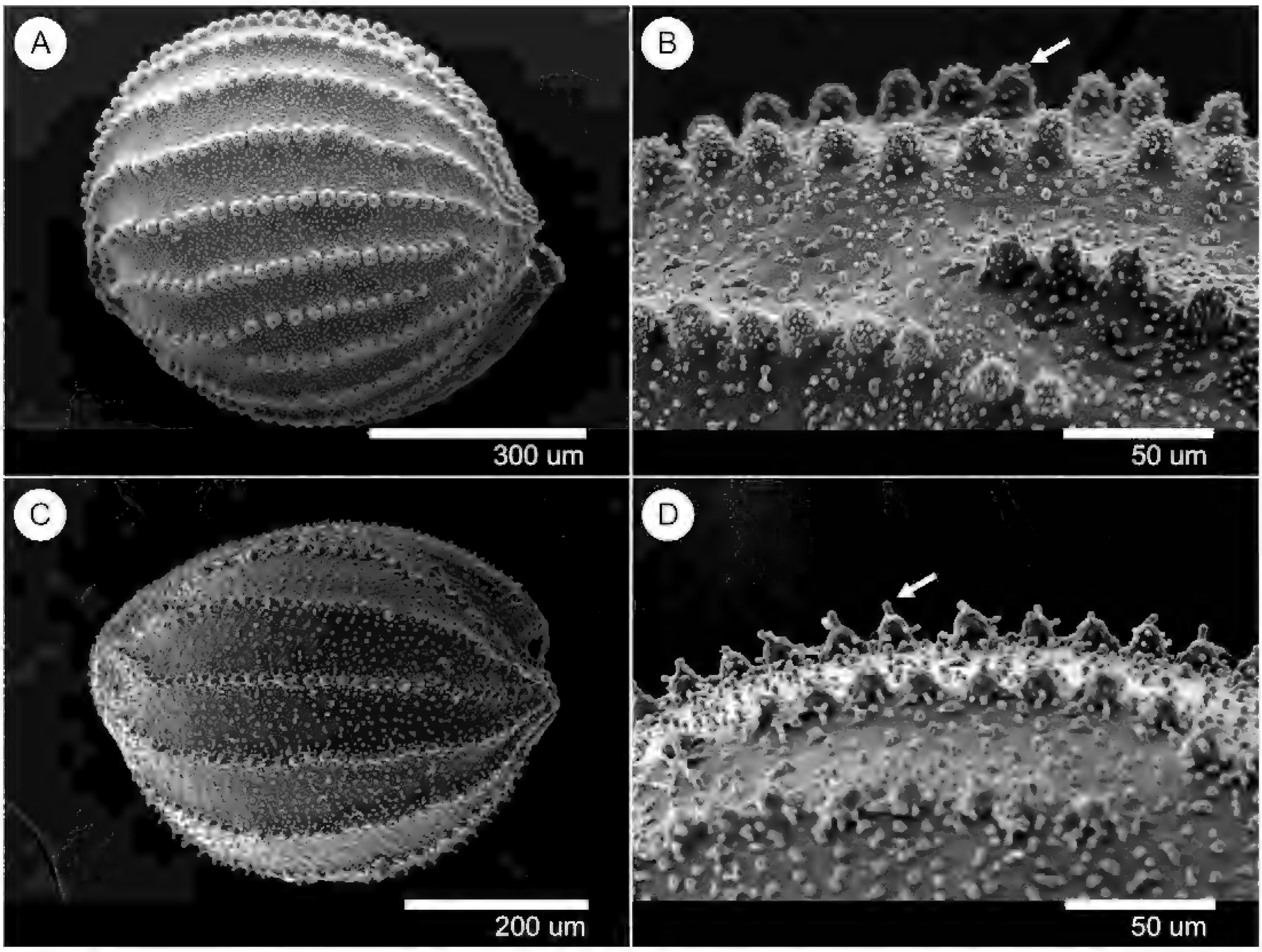


Figure 2. Seeds of *Chrysosplenium sphaerospermum* Maxim. (A, B) and *C. aureobracteatum* Y. I. Kim & Y. D. Kim (C, D). —A. Seed of *C. sphaerospermum*. —B. Close-up of seed surface, revealing ridges with more than 10 deciduous papillae on tubercle (arrow). —C. Seed of *C. aureobracteatum*. —D. Close-up of seed surface, showing ridges of tubercules that are topped by less than 10 deciduous papillae (one indicated at arrow). A and B taken from *KYI-2013023* (HHU); C and D taken from *KYI-2013029* (HHU).

2–12 × 2–12 mm, both leaf surfaces and margin glabrous, or adaxial leaf surface with sparse clusters of brown pilose trichomes along veins, blade margins obscurely undulate to crenate or distinctly obtusely dentate, with (4)5 to 9 teeth, subtruncate at apex; petioles (1–)3–8 mm, pilose, light green. Inflorescence a 4- to 16-flowered cyme; pedicels sparsely pilose; adaxial bracteal leaves golden-yellow at flowering, turning to light green or yellowish green after fruiting, subflabellate, 5–15 × 5–12 mm, both surfaces glabrous, margins glabrous or sparsely pilose, obscurely undulate to crenate or distinctly obtusely dentate, with 4 to 8 teeth, obtuse to subtruncate at apex; petioles 1–3 mm, sparsely pilose. Flowers with 4 petaloid sepals, one pair overlapping the other in bud, persistent, erect, yellow, widely ovate to widely subelliptic, 1.8–2.2 × ca. 2 mm, obtuse to truncate at apex, slightly recurved at apex; petals absent; stamens eight, 0.6–1 mm, shorter than sepal, filaments filiform, 0.4–0.7 mm; anthers yellow, 2-locular, 0.2–0.4 mm, laterally dehiscent; ovary semi-inferior, 1-locular, 2-carpellate, with 2 parietal placentae, 0.5–1.4 mm, styles 2, free, ca. 1 mm, stigma punctate, disc absent. Fruit a 2-lobed capsule, ellipsoid, pale green, ca. 5.5 mm, the lobes horn-shaped, slightly unequal, each lobe dehiscent along an adaxial suture; seeds numerous, dark brown, narrow ellipsoid with a carina on one side, thick-walled, 0.6–0.8 × 0.5–0.6 mm, with 12 to 17 longitudinal ridges with prolate hemispheroidal tubercles ca. 10 μm in diam., each with 1 to 10 papillae ca. 5 μm long.

Distribution and habitat. *Chrysosplenium aureobracteatum* is known from Mt. Gwangdeok, Mt. Daeseong, and Mt. Dosol in Gangwon Province and from Mt. Yeonin and Mt. Yoomyeong in Gyeonggi Province in South Korea. The new species has been collected from 630 to 910 m in elevation, occurring in deciduous forests of mountain valleys, where it grows in humid and semi-shady areas near small creeks.

Table 1. Morphological comparison of *Chrysosplenium aureobracteatum* Y. I. Kim & Y. D. Kim and *C. sphaerospermum* Maxim.

Characters	*C. aureobracteatum*	*C. sphaerospermum*
Distal leaf pairs on sterile branch after fruiting	distant, with long internodes	clustered, with very short internodes
Bracteal leaf color (adaxial surface)	golden-yellow	green
Seed length (mm)	0.6–0.8	0.6–0.8
Seed width (mm)	0.5–0.6	0.6–0.7
Seed length:width ratios	1.25 (1.12–1.4):1	1.13 (0.94–1.22):1
Number of ridges on a seed	12 to 17	16 to 20
Tubercles on seed ridge diameter (μm)	ca. 10	ca. 15
Tubercles on seed ridge shape	prolate hemispheroidal	hemispheroidal
Papillae on a tubercle number	1 to 10	< 10
Papillae on a tubercle length (μm)	ca. 5	1.5–2.5

IUCN Red List category. *Chrysosplenium aureobracteatum* may be categorized as Endangered (EN) under B1ab (iii) criteria of the IUCN Red List Categories and Criteria (IUCN, 2001). Only five populations are known, with its extent of occurrence (EOO) estimated to be less than 5000 km^2 in all five populations. Another reason for the endangered assessment is the continuing reduction of its habitat due to expansion of forest roads after its initial discovery on Mt. Gwangdeok, a well-known hiking spot.

Phenology. *Chrysosplenium aureobracteatum* was observed in flower in late March to early May and in fruit in late May to early July.

Etymology. The specific epithet of this new species is taken from the Latin *aureus* and *bractea*, which refers to the distinctive feature of the species having golden-yellow bracts at the time of flowering.

Discussion. Specimens of *Chrysosplenium aureobracteatum* have been previously misidentified as *C. sphaerospermum* [= *C. pilosum* var. *fulvum*], principally because the diagnostic golden-yellow color of the bracteal leaves is ambiguous in dried specimens. Another important diagnostic character, the repent habit of sterile stems after fruiting, is also difficult to discern in dried material, which delayed discovery of this new species. This rather cryptic species is supported by recent molecular systematic analyses that utilized multiple accessions from several populations of the taxa examined (Kim & Kim, 2011). Within the ITS tree, the nine accessions representing the new species formed a distinct clade with a high bootstrap value (99%) and posterior probability (1.0), supporting their divergence from the sister taxon *C. sphaerospermum*. This new taxonomic entity could have been described as a new variety of *C. pilosum*, but recent phylogenetic study revealed the species *C. pilosum* recognized by Hara (1957) to be a paraphyletic taxon (Han et al., 2011), implying that the recognition of additional varieties within *C. pilosum* would be taxonomically inappropriate. This leads us to propose the new taxon at the rank of species rather than as a variety within *C. pilosum*.

It should be emphasized that not only phenological characters and molecular data support the new species; the seed morphology also distinguishes *Chrysosplenium aureobracteatum* from closely allied taxa (Table 1, Fig. 2). The seed shape of *C. aureobracteatum* is a narrow ellipsoid with lower furrows (i.e., lower ridged) compared to that of *C. sphaerospermum*. The number of papillae on each tubercle are fewer, only one to 10 in *C. aureobracteatum*, whereas this number exceeds 10 in *C. sphaerospermum* (Fig. 2). Since the seed morphology has been considered useful and important for delimiting the taxa of *Chrysosplenium* (Hara, 1957; Han et al., 2011), these distinctive seed characters support the recognition of *C. aureobracteatum* from its closely allied taxon.

Paratypes. SOUTH KOREA. **Gangwon:** Mt. Gwangdeok, Gwangdeok-ri, Sanae-myeon, Hwacheon-gun, N 38°06′24.1″, E 127°26′45.7″, 732 m, 27 Apr. 2009, *KYI-2009022* (HHU), N 38°06′10.7″, E 127°26′45.0″, 663 m, 25 May 2009, *KYI-20090025* (HHU), N 38°06′17.8″, E 127°26′36.1″, 637 m, 25 May 2009, *KYI-2009026* (HHU), *KYI-2009027* (HHU), *KYI-2009028* (HHU), *KYI-2009032* (HHU), *KYI-2009033* (MO); Mt. Daeseong, Bong-o-ri, Sangseo-myeon, Hwacheon-gun, N 38°12′24.0″, E 127°31′35.8″, 704 m, 2 May 2008, *Youngdong Kim 2008-0062* (HHU); Mt. Dosol, Haean-myeon, Yanggu-gun, N 38°15′00.5″, E 128°06′09.6″, 858 m, 4 May 2012, *KYI-20120001* (HHU), *KYI-2012002* (HHU), *KYI-2012007* (HHU), *KYI-2012012* (MO). **Gyeonggi:** Mt. Yeonin, Seungan-ri, Gapyeong-eup, Gapyeong-gun, N 37°53′04.5″, E 127°24′22.2″, 701 m, 14 May 2010, *KYI-2010001* (HHU), *KYI-2010002* (HHU).

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Two New Species of Myrtaceae from Colombia

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Abstract. Two new species of Myrtaceae are described and illustrated from western tropical humid forests from Valle del Cauca, Colombia. *Eugenia calimensis* C. Parra-O. is distinguished by leaf shape and densely pubescent inflorescences, and it is somewhat similar to *E. chrysophyllum* Poir. in the upper surface of the leaf blades and the inflorescence shape. *Myrcia icnii* C. Parra-O. is affined to *M. lapidulosa* B. Holst & M. L. Kawas., having similar leaf blades that are elliptic to obovate, coriaceous, and abaxially more or less bullate.

Resumen. Se describen e ilustran dos nuevas especies de Myrtaceae de los bosques húmedos tropicales del occidente del Valle del Cauca, Colombia. *Eugenia calimensis* C. Parra-O. se caracteriza por la forma de sus hojas, y por sus inflorescencias densamente pubescentes, siendo similar a *E. chrysophyllum* Poir. por la superficie foliar de la lámina de las hojas, y por el tamaño y la forma de la inflorescencia. *Myrcia icnii* C. Parra-O. es afín a *M. lapidulosa* B. Holst & M. L. Kawas., ya que ambas especies presentan láminas foliares elípticas a obovadas, coriáceas, y más y menos abolladas por el envés.

Key words: Colombia, *Eugenia*, IUCN Red List, *Myrcia*, Myrtaceae, Valle del Cauca.

Among Colombian native Myrtaceae, *Eugenia* L. and *Myrcia* DC. are the most diverse genera with 41 and 27 species, respectively. Nevertheless, through continuing study of the taxonomy of Colombian Myrtaceae I estimate that undescribed species of *Eugenia* and *Myrcia* in Colombia constitute at least half of the number of the species for both genera. Herein I describe new species of *Eugenia* and *Myrcia* from Colombia.

1. Eugenia calimensis C. Parra-O., sp. nov. TYPE: Colombia. Valle del Cauca: Bajo Calima, ca. 15 km N of Buenaventura, Carton de Colombia concession, 3°56′N, 77°08′W, ca. 50 m, 13 Feb. 1983 (fl., fr.), *A. Gentry, A. Juncosa & H. Mazuera 40196* (holotype, MO; isotype, COL). Figure 1.

Haec species quoad folia adaxialiter glabra ac inflorescentiam breviter racemosam *Eugeniae chrysophyllo* Poir. subsimilis, sed ab ea foliis abaxialiter trichomatibus aureo-brunneis sparsim modiceve pubescentibus (vs. sericeis) atque fructu globoso (vs. ellipsoideo) distinguitur.

Tree, 10–12 m tall; hairs when present 0.1–0.3 mm, simple, golden-brown; young branches ± compressed, moderately to densely pubescent; old branches ± compressed to terete, glabrous to glabrescent. Leaf blades widely elliptic, occasionally elliptic, 14–22.5 × (6.7)8.2–14.8 cm, coriaceous, upper surface generally glabrous, occasionally glabrescent, with impressed and almost imperceptible glandular dots, lower surface sparsely to moderately pubescent, with raised brownish orange glands, apex apiculate, apiculum 2.8–7.2 mm, base subcordate, sometimes obtuse, blade margin moderately to markedly revolute; midvein slightly convex above, glabrous to moderately pubescent, convex below, moderately to densely pubescent; lateral veins in 10 to 13 pairs, convex on both blade surfaces, glabrescent to moderately pubescent, venation joining in an inframarginal vein at 1–2.9 mm from margin; petiole 9–12 mm, reddish or blackish brown, rugose, moderate to densely pubescent, terete. Inflorescence axillary, briefly racemose, 0.7–1 cm, solitary (2 or 3) at the nodes, with 4 to 7 flowers per raceme, fertile axes rectangular or compressed, densely pubescent, brown to golden-brown; peduncles 0.4–0.7 × 0.8–1 mm; bracts widely ovate, 0.5–1 × 0.6–1 mm, glabrescent to moderately pubescent, basally truncate, persistent; bracteoles 2, opposite at base of hypanthium, connate at base, widely ovate, 0.8–0.9 × 0.9–1.2 mm, glabrescent to moderately pubescent (especially pubescent at margin and apex), persistent after anthesis. Flowers with buds obovoid or globose, 2–2.9 × 2–2.5 mm, moderately pubescent, on ± compressed pedicels, 4.8–7 × 0.5–0.6 mm, densely pubescent; sepal lobes 4, in unequal pairs, outer pair widely triangular, 1.1–1.5 × 0.8–1.6 mm, inner pair widely ovate, 1.2–1.4 × 1.6–1.8 mm, both glabrescent to sparsely pubescent outside, glabrous inside, apex obtuse or subobtuse; petals 4, white, obovate or widely elliptic, 2.9–3.4 × 2.1–2.4 mm, glabrous except for ciliate margin, apex obtuse, base truncate; stamens forty to sixty, 2.1–3.6 mm;

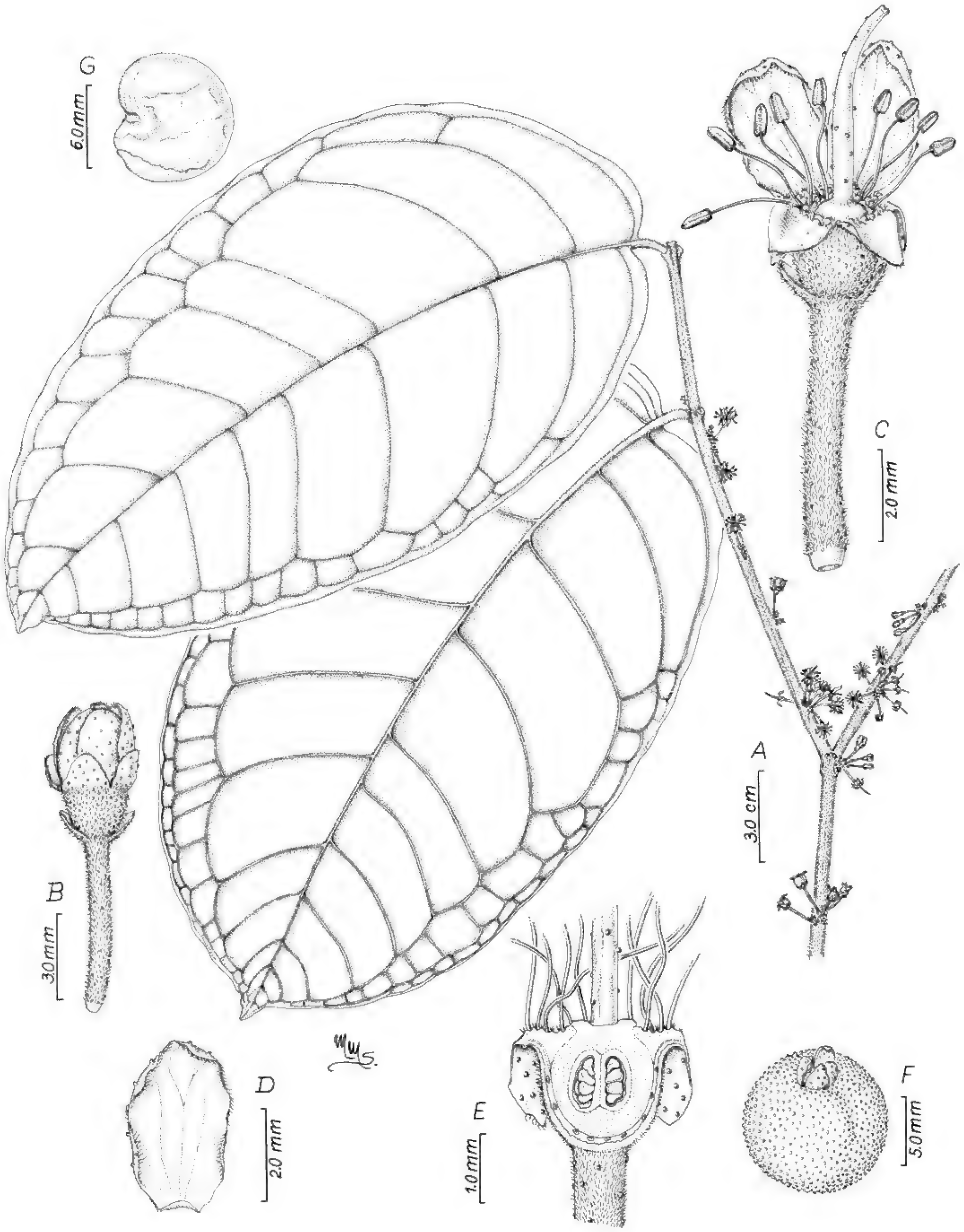


Figure 1. *Eugenia calimensis* C. Parra-O. —A. Flowering branch. —B. Flower bud. —C. Flower after anthesis, with two petals and most of the stamens removed. —D. Petal, with ciliate margin. —E. Longitudinal section of hypanthium and ovary. —F. Fruit. —G. Seed. A, C–E are drawn from the holotype, *Gentry et al. 40196* (MO); B, F, G drawn from the isotype, *Gentry et al. 40196* (COL).

filaments 1.6–3.1 mm, anthers ellipsoid, 0.5 mm, bearing 1 apical gland; hypanthium 1.6–1.8 mm diam., not prolonged above the ovary, moderately to densely pubescent outside, glabrous inside; disk 1.9–2.1 mm diam., moderately pubescent; ovary 1–1.1 mm diam., 2-locular, 6 to 11 ovules per locule, style 3.7–4.3 mm, glabrous. Fruits globose, red or blackish, 7.9–8.7 mm diam., exocarp glabrous to

glabrescent; seeds 1 per fruit, slightly reniform, 8.7 × ca. 8 mm, seed coat papyraceous, brownish yellow, smooth, with blackish glands; embryo eugenioid.

Habitat and etymology. The specific epithet of the new species refers to the Bajo Calima region, which is located in the western tropical humid forests in the department of Valle del Cauca, at elevations between 0 and 150 m. The forests of this region are considered among the most species rich in the world (Faber-Langendoen & Gentry, 1991), and several new species of angiosperms have been described, some of which are endemic to the western tropical humid forests (e.g., Wasshausen, 1989; Lozano-Contreras, 1994; Taylor et al., 1999; Croat et al., 2007; Ricketson & Pipoly, 2008).

IUCN Red List category. As this new species is only known from one location, and no other collections have been found, the conservation status of *Eugenia calimensis* can only be assessed as Data Deficient, or DD, according to IUCN Red List criteria (IUCN, 2001).

Discussion. *Eugenia calimensis* is a distinctive species among Colombian *Eugenia* and is recognized by its widely elliptic, apiculate, coriaceous leaves, by the briefly racemose, densely pubescent inflorescences only to 1 cm long, and by the small flower buds no more than 2.9 mm in length. *Eugenia calimensis* is somewhat similar to *E. chrysophyllum* Poir., a species known from Panama, Colombia, Peru, and Brazil and from Venezuela to French Guiana. The upper surface of leave blades on both species is glabrous, and their inflorescences are similar in shape. *Eugenia calimensis* differs from *E. chrysophyllum* by the pubescence of the lower surface of leaf blade (sparsely to moderately pubescent with golden-brown hairs vs. sericeous) and by its fruit shape (globose vs. ellipsoid).

Paratype. COLOMBIA. **Valle del Cauca:** Bajo Calima, ca. 15 km N of Buenaventura, Carton de Colombia concession, 3°56′N, 77°08′W, ca. 50 m, 16 Feb. 1983 (bud, fr.), *A. Gentry, A. Juncosa, H. Mazuera & W. Ladrach 40357* (COL, MO).

2. Myrcia icnii C. Parra-O., sp. nov. TYPE: Colombia. Valle del Cauca: Bajo Calima, Concesión Pulpapel/Buenaventura, 3°55′N, 77°W, ca. 100 m, 3 Aug. 1984 (fl., fr.), *M. Monsalve 163* (holotype, CUVC; isotype, MO). Figure 2.

Haec species quoad folia coriacea elliptica obovatave abaxialiter bullata *Myrciae lapidulosae* B. Holst & M. L. Kawas ut videtur affinis, sed ab ea foliis majoribus (26–33 × 13.5–20 cm vs. 8–16.5 × 3.5–11 cm), panicula plerumque longiore ([7] 18–24 cm vs. 5–10 cm), petalis brevioribus (2.4–2.9 mm vs. ca. 7 mm), fructu minore (0.9–1.2 cm vs. ca. 2.2 cm) atque seminibus minoribus (5.6–7 mm vs. ca. 15 mm) distinguitur.

Tree, 5–6 m tall; hairs when present 0.1–0.5(0.7) mm, simple, light golden; young branches flattened to ± compressed, moderately to densely pubescent; old branches ± compressed to terete, glabrous to glabrescent. Leaf blades elliptic or obovate, 26–33 × 13.5–20 cm, coriaceous, upper surface glabrous, with impressed glandular dots, lower surface glabrescent to slightly pubescent, slightly bullate, with raised brownish orange glands, apex apiculate, apiculum 7.3–10 mm, base cuneate, margin entire; midvein above flat to slightly convex (at least in distal 2/3), slightly convex to convex to apex, generally glabrous (occasionally glabrescent), strongly convex below, moderately to densely pubescent; lateral veins in 21 to 24 pairs, flat above, glabrous, convex below, moderately to densely pubescent, marginal veins 2, inner one 2.7–4 mm from margin, outer one 0.5–1 mm from margin, sometimes almost imperceptible; petiole 8–13 mm long, dark brown, slightly rugose, moderately to densely pubescent, canaliculate. Inflorescence subterminal, paniculate, (7)18–24 cm, with 40 to 60 flowers per panicle, axes compressed, densely pubescent, brown to purple-brown; pedunculos 60 × 3–3.7 mm; bracts unknown; bracteoles unknown. Flower buds unknown; flowers sessile; sepal lobes 5, widely triangular to depressed ovate, 1.7–1.9 × 2.6–3.3 mm, moderately pubescent both outside and inside, with brownish orange glands, apex obtuse to ± obtuse; petals 4, obovate or widely elliptic, 2.4–2.9 × 2.3–2.6 mm, dorsally glabrescent, ventrally moderately to densely pubescent, apex obtuse to ± obtuse, base truncate to cuneate; stamens seventy to ninety, 2.6–4.3 mm; filaments 2.3–4 mm, anthers globose, 0.3 mm, without apical glands; hypanthium 1.9–2.3 mm diam., not prolonged above ovary, moderately to densely pubescent both outside and inside; disk 3.6 mm diam., densely pubescent; style 5.2 mm, moderately pubescent at base, glabrescent from middle to apex; ovary 1.8 mm diam., 2-locular, 1 or 2 ovules per locule; style 5.2 mm, moderately pubescent at base, glabrescent from middle to apex. Fruits ellipsoid, red, 0.9–1.2 cm, exocarp moderately pubescent; seeds developing as 1 per fruit, slightly reniform, 5.6–7 × 3.5–4.3 mm, seed coat papyraceous, brownish orange, smooth, with immersed glands; embryo myrcioid.

IUCN Red List category. Because this new species is only known from one location, and no

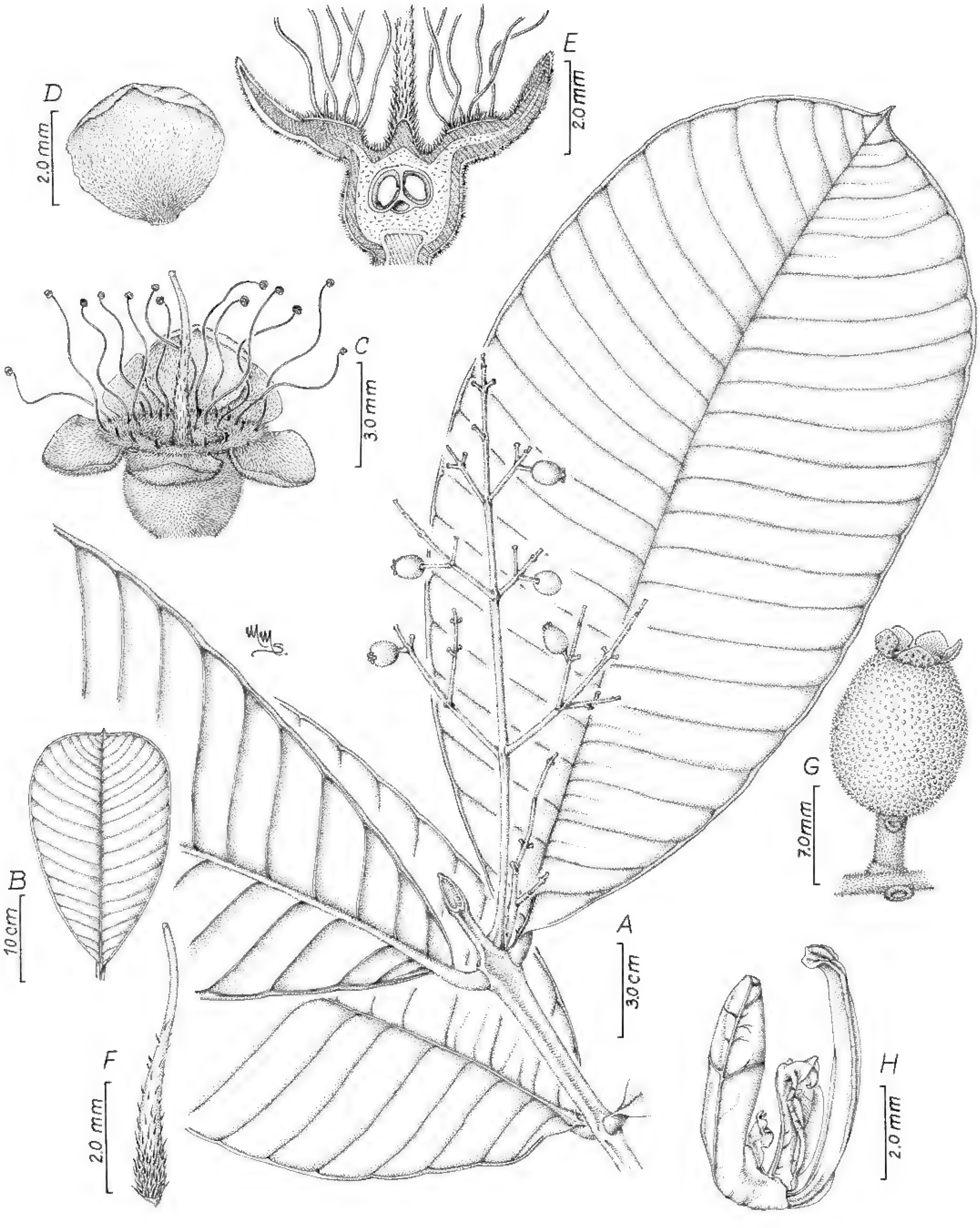


Figure 2. *Myrcia icnii* C. Parra-O. —A. Fruiting branch, with elliptic leaves. —B. General view of one leaf, showing shape variation as an obovate leaf blade. —C. Flower after anthesis, with some sepals, most of the petals, and most of the stamens removed. —D. Petal, showing pubescence and more or less obtuse apex. —E. Longitudinal section of hypanthium and ovary, showing the single ovule per locule. —F. Detail of style, with moderate pubescence basally. —G. Fruit, with persistent calyx and immersed glands visible. —H. Myrcioid embryo. A, C–F are drawn from the holotype, *M. Monsalve 163* (CUVC); B from *I. Cabrera et al. 15606* (CUVC); G and H from the isotype, *M. Monsalve 163* (MO).

other collections have been found, the conservation status of *Myrcia icnii* can only be assessed as Data Deficient, or DD, according to IUCN Red List criteria (IUCN, 2001).

Etymology. *Myrcia icnii* is named to honor the Instituto de Ciencias Naturales (ICN), my home institution at the Universidad Nacional de Colombia, which has been a leader in research in taxonomy and

systematics of Colombian flora and fauna for more than 75 years. The epithet choice as an arbitrary noun is supported by Article 23.2 of the International Code of Nomenclature for algae, fungi, and plants (Melbourne Code; McNeill et al., 2012).

Discussion. *Myrcia icnii* seems to be related to *M. lapidulosa* B. Holst & M. L. Kawas., a species from Panama. The leaves of the species are similar in shape (elliptic or obovate blades), thickness (coriaceous), and texture of the blade surface (slightly bullate to bullate on the lower surface). Nevertheless, *M. icnii* differs from *M. lapidulosa* by the size of its larger leaves (26–33 × 13.5–20 cm vs. 8–16.5 × 3.5–11 cm in *M. lapidulosa*), by its shorter petals (2.4–2.9 mm vs. ca. 7 mm), its typically longer panicles ([7]18–24 cm vs. 5–10 cm), its smaller fruits (0.9–1.2 cm vs. ca. 2.2 cm), and its smaller seeds (5.6–7 mm vs. ca. 15 mm).

Paratype. COLOMBIA. **Valle del Cauca:** Bajo Calima, 50 m, 8 July 1987 (st.), *I. Cabrera et al. 15606* (CUVC).

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Two New Species of *Eugenia* (Myrtaceae) from Coastal Brazilian Rainforest

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Abstract. Two new species of the genus *Eugenia* L. from the Atlantic coastal forests of the southeastern Brazilian states of Bahia and Espírito Santo are described, illustrated, compared with related species, and evaluated in their IUCN conservation status. *Eugenia cataphyllea* M. C. Souza & Sobral is related to *E. xanthoxyloides* Cambess., from which it differs by the longer cataphylls, larger and pilose leaves, bracteoles persisting after anthesis and pilose flowers. *Eugenia hispidiflora* Sobral & M. C. Souza is apparently related to *E. hirta* O. Berg, from which it can be distinguished by its longer leaves and densely hispid flowers.

Resumo. Duas novas espécies do gênero *Eugenia* L. ocorrentes na Mata Atlântica dos estados da Bahia e Espírito Santo, no sudeste do Brasil, são descritas, ilustradas, comparadas com as espécies próximas e avaliadas em seu status de conservação de acordo com os critérios da IUCN. *Eugenia cataphyllea* M. C. Souza & Sobral é próxima a *E. xanthoxyloides* Cambess., diferindo pelos catáfilos mais longos, folhas maiores e pilosas, bractéolas persistentes após a antese e flores pilosas, e *E. hispidiflora* Sobral & M. C. Souza é aparentemente próxima a *E. hirta* O. Berg, da qual se distingue pelas folhas maiores e flores maiores e densamente híspidas.

Keywords: Atlantic rainforest, Brazil, *Eugenia*, IUCN Red List, Myrtaceae.

Eugenia L. is a pantropical genus of about 1000 species (Govaerts et al., 2014), with 378 species growing in Brazil (Sobral et al., 2014). The genus is common in the Atlantic rainforest along the coast of Brazil (Thomaz & Monteiro, 1997; Negrelle, 2002; Amorim et al., 2005; Jesus & Rolim, 2005). During the examination of collections from the coastal rainforests of southern Bahia and northern Espírito Santo, we found two distinctive species of *Eugenia* that are herein proposed as new.

1. Eugenia cataphyllea M. C. Souza & Sobral, sp. nov. TYPE: Brazil. Espírito Santo, mun. Linhares, Reserva Natural da Vale do Rio Doce, 24 Sep. 2001, *D. A. Folli 4068* (holotype, RB; isotypes, BHCB, CVRD, HUFSJ). Figure 1.

Diagnosis. This species is related to *Eugenia xanthoxyloides* Cambessèdes, from which it is distinguished by the cataphylls to 20 mm along the twigs (vs. to 10 mm), leaf blades to 105 × 45 mm and abaxially pilose (vs. to 40 × 20 mm and glabrous), bracteoles persisting at anthesis (vs. deciduous), and ovaries densely pilose (vs. glabrous).

Shrub ≤ 2 m. Twigs terete, the 2 or 3 distal internodes 30–60 mm, 1–2 mm in diameter, cylindrical, hirsute, with white simple trichomes ≤ 1 mm and protected by 7 to 10 pairs of narrowly oblong, concave cataphylls, the proximal ones widely ovate ≤ 3 × 1.5–2 mm, increasingly longer distally, about 5 × 2 mm to 10 × 2 mm medially, the most distal ones reaching 15–20 × 1.5–2 mm, the most distal ones glabrous or occasionally with scattered simple white trichomes to 0.5 mm abaxially, older twigs mostly glabrous, without cataphylls and somewhat exfoliating longitudinally. Leaves with petioles 1–2 × 1.2–2 mm, visible mostly abaxially, hirsute, densely covered with rufescent trichomes to 1 mm; blades narrowly elliptic or obovate, 50–105 × 23–45 mm, 2 to 2.5 times longer than wide, discolored when dry, lighter abaxially, apex acute to acuminate in 5–10 mm, base rounded or cordiform; glandular dots, < 0.1 mm in diameter, 20 to 30/mm^2, visible abaxially; lateral veins 12 to 15 at each side, leaving the midvein at angles of 50°–80°, moderately salient adaxially and less so abaxially, midvein markedly sulcate adaxially and prominent abaxially, glabrous adaxially and with simple white or brown trichomes 0.8–1 mm abaxially, most dense along the midvein, marginal veins 2, the inner one 2.5–3 and the outer one 0.3–1 mm from the revolute margin. Inflorescences terminal, racemiform, axis at anthesis



Figure 1. *Eugenia cataphyllea* M. C. Souza & Sobral. Image of holotype, *D. A. Folli 4068* (RB).

to 5 × 1 mm, glabrous, with 2 to 4 flowers, protected basally by 5 to 6 series of glabrous bracts, these shining in dried material and bearing a mucilaginous covering (sticky when fresh, according to personal information by the collector), the basal ones ovate, to 1 × 2 mm, increasing distally up to narrowly elliptic, 6 × 1.5–2 mm; bracts subtending flowers not observed; pedicels 6–8 × 0.4 mm, hirsute, with white simple trichomes to 0.4 mm; bracteoles oblong to oblong-spathulate, concave, 4–5 × 0.5–1 mm,

glabrous or with cilia to 0.3 mm, persisting after anthesis, with 5 to 6 pairs of linear colleters 0.5–1.5 × 0.1–0.4 mm at its adaxial base; flower buds elliptic, to 5 × 4 mm, the ovary densely covered with white erect trichomes 0.5–0.8 mm, contrasting with the glabrous calyx lobes, these 4, equal or nearly so, widely ovate, 3–3.5 × 1.8–3 mm, moderately concave, patent at anthesis, with visible glands abaxially, with hyaline margin about 0.2 mm wide and cilia 0.2–0.4 mm; petals 4, elliptic to obovate, equal, 6–7 × 5–6 mm, white, glabrous; stamens seventy to eighty, 3–7 mm, anthers subglobose, 0.2 × 0.3 × 0.3 mm, eglandular; staminal ring rounded, to 2 mm in diameter, with scattered white trichomes to 0.2 mm; style to 10 mm, stigma punctiform, slightly papilose; ovary 2-locular, with 14 to 17 ovules per locule. Fruits immature, globose, to 6 mm in diameter, with white trichomes as the ovary but less dense, crowned by the calyx lobes; seeds not seen.

Distribution, habitat, and phenology. *Eugenia cataphyllea* is a shrub in rainforests of northern coastal Espírito Santo, collected at altitudes of 20–60 m at the Vale do Rio Doce Natural Reserve, in the municipality of Linhares. It is presently known only from the type material, collected with flowers and immature fruits in September.

IUCN Red List category. Considering that *Eugenia cataphyllea* is presently known only from three collections from the same place, the Vale do Rio Doce Natural Reserve at Linhares, more detailed information that could help assign it to an IUCN conservation category (IUCN, 2012) is missing, so it must be presently scored as DD (Data Deficient).

Etymology. The epithet alludes to the presence of cataphylls in the twigs of this species, an uncommon character in Brazilian species of *Eugenia*, presently registered only for this species, *E. xanthoxyloides*, and the unrelated *E. myrciariifolia* Soares-Silva & Sobral (for a description, see Soares-Silva & Sobral, 2004).

Vernacular name. Batinga-melosa (*Folli 6217* [CVRD, HUFSJ]).

Relationships. *Eugenia cataphyllea* is related to *E. xanthxyloides*, a species native to the state of Rio de Janeiro (for a description, see Cambessèdes, 1832–1833; Berg, 1857–1859), from which it is distinguished by the characters presented in the diagnosis.

Paratypes. BRAZIL. **Espírito Santo:** mun. Linhares, Reserva Natural da Vale do Rio Doce, Antiga Estrada do MME, 23 Oct. 2008, *G. S. Siqueira 447* (CVRD, HUFSJ), Estrada do Aceiro Bobbio, 30 Oct. 2008, *D.A. Folli 6217* (CVRD, HUFSJ).

2. Eugenia hispidiflora Sobral & M. C. Souza, sp. nov. TYPE: Brazil. Espírito Santo, mun. Linhares, Reserva Natural da Vale do Rio Doce, 28 Nov. 2002, *D. A. Folli 4431* (holotype, RB; isotypes CVRD, HUFSJ). Figure 2.

Diagnosis. This species is related to *Eugenia hirta* O. Berg, from which it is kept apart by its larger blades (to 140 × 40 mm vs. to 50 × 30 mm), 2–3.2 times longer than wide (vs. 1.3–2 times longer than wide), with ≤ 16 lateral veins at each side (vs. ≤ 8), inflorescences racemiform with axes to 8 mm with ≤ 8 flowers (vs. inflorescences with no visible axis, mostly uniflorous or with two flowers), and flowers densely covered with trichomes to 2 mm, these more dense on the ovary than on the calyx lobes (vs. flowers sparsely and uniformly covered with trichomes to 0.5 mm).

Shrub ≤ 3 m. Twigs terete, the 2 or 3 more distal internodes 40–60 mm, 0.5–1 mm in diameter, cylindrical, sometimes exfoliating longitudinally, new twigs with simple erect white trichomes, 1–2 mm, these falling with age. Leaves with petioles 1–2 × 0.8–2 mm, visible mostly abaxially, with trichomes to 1 mm; blades ovate-oblong to oblong or lanceolate, 60–140 × 27–43 mm, 2–3.2 times longer than wide, slightly discolored when dry, lighter abaxially, glabrous adaxially and with simple erect trichomes 1–2 mm abaxially, these scattered along the surface in younger blades and mostly restricted to the midvein with age; apex acuminate in 12–18 mm; base cordiform; glandular dots faintly visible abaxially, ≤ 0.1 mm in diameter, 5 to 10 per square millimeter; midvein moderately sulcate adaxially and prominent abaxially; lateral veins 12 to 16 at each side, leaving the midvein at angles of 70°–80°, moderately to markedly sulcate adaxially and salient abaxially; marginal veins 1 or occasionally 2, the inner one 2–4 mm, the outer one when present 0.5–1 mm from the revolute and sometimes undulate margin. Inflorescences terminal or axillary, occasionally ramiflorous, racemiform, axis 2–8 × 0.7–0.8 mm, with 2 to 6 flowers, then solitary; bracts oblong, 0.8–1 × 0.4 mm, glabrous or with cilia to 0.1 mm; pedicels 10–15 × 0.2–0.3 mm, uniformly covered with simple erect white trichomes 1–2 mm; bracteoles triangular, to 0.5 × 0.3 mm, glabrous or with trichomes as the pedicels, persisting after anthesis, colleters not observed; flower buds obpyriform, 4–5.5 × 3–4 mm, densely pubescent especially in the ovary, which contrasts with the less pubescent calyx lobes, these four being 4–5 × 1–1.3 mm, explanate at anthesis, markedly concave, elliptic to narrowly elliptic, subequal, adaxially glabrous, abaxially markedly



Figure 2. *Eugenia hispidiflora* Sobral & M. C. Souza. Image of holotype, *D. A. Folli 4431* (RB).

glandulose and hispid with erect simple trichomes 1–2 mm, margin hyaline for ca. 0.2 mm, with cilia to 0.2 mm; petals 4, elliptic, in two slightly unequal pairs, 5–7 × 4–6 mm, white, glabrous or with apical tufts of cilia to 0.1 mm; stamens sixty to seventy, 5–7 mm, anthers ovate-oblong, 1.5–1.8 × 0.6–0.7 mm, with one apical gland; staminal ring subquadrate, glabrous, ≤ 1 mm in diameter; style ≤ 10 mm, stigma punctiform or slightly capitate, moderately papillose; ovary 2-locular, with 5 to 9 ovules per locule. Fruits

globose to slightly elliptic, red when ripe, 10–12 × 9–10 mm, with scattered erect trichomes as the flowers, crowned by the calyx lobes, these sometimes enlarged to 7 × 4 mm; seeds as far as observed one per fruit, globose, testa light brown and easily detachable, the embryo with fused cotyledons and no visible hypocotyl.

Distribution, habitat, and phenology. *Eugenia hispidiflora* is a shrub in rainforests along the coastal regions of northern Espírito Santo and southern Bahia, found at elevations of 20–60 m. Flowers have been collected in November, and fruits in January and February.

IUCN Red List category. *Eugenia hispidiflora* is presently known from three municipalities; plotting the presently known distribution results in an extent of occurrence of 10,777 km² (geographical references, except for *Oliveira, França, Melo & Silva 596* [HUEFS, HUFSJ], are based on the municipalities location; extent of occurrence is obtained via Geocat [<http://geocat.kew.org>]; see Bachman et al., 2011), an area that suggests the Vulnerable (VU) conservation category (IUCN, 2012); however, there is no additional information about its occurrence in the area between the collection sites; considering this, until new collections permit a more adequate evaluation, it seems more adequate to score the conservation status of *E. hispidiflora* as DD (Data Deficient).

Etymology. The epithet alludes to the covering of firm erect trichomes of the flowers of this species.

Relationships. *Eugenia hispidiflora* is related to *E. hirta* (for a description, see Berg, 1857–1859: 574), a species native to Bahia, from which it is distinguished by the characters cited in the diagnosis.

Paratypes. BRAZIL. **Bahia:** mun. Camacan, estrada a Itaimbé, 20 Jan. 1971, *T. S. Santos 1374* (CEPEC); mun. Porto Seguro, 22 km do entroncamento da BR-367 com BA-001, 16°28′08″ S, 39°09′06″ W, 29 May 2000, *R. P. Oliveira, F. França, E. Melo & B. M. Silva 596* (HUEFS, HUFSJ). **Espírito Santo:** mun. Linhares, Reserva Natural da Vale do Rio Doce, Feb. 2007, *J. R. Stehmann 4748* (BHCB, CVRD), Estrada da Jueirana Facão, 11 Jan. 2008, *M. C. Souza 571* (CVRD, HUFSJ, RB), Estrada Municipal do MME, 5 Jan. 2010, *D. A. Folli 6526* (CVRD, HUFSJ).

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Gossypium anapoides (Malvaceae), a New Species from Western Australia

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Abstract. *Gossypium anapoides* J. M. Stewart, Craven, Brubaker & Wendel (Malvaceae), a new species of *Gossypium* L. endemic to the north Kimberley region of Western Australia, is described. The species is erect, with multiple, unbranched stems arising from the crown of a woody lignotuber. This trait, along with the presence of an elaiosome on each seed and the results of molecular analyses, places it with the species of *Gossypium* sect. *Grandicalyx* (Fryxell) Fryxell and makes it phylogenetically sister to the geographically disjunct species *G. cunninghamii* Tod. The species is named for the unique raised venation on the adaxial leaf surface that imparts the appearance of an abaxial surface.

Key words: Australia, *Gossypium*, *Gossypium* sect. *Grandicalyx*, IUCN Red List, Malvaceae.

The monsoonal north Kimberley region of Australia is climatically distinct within the Australian continent, being characterized by wet and dry climatic cycles. During the wet cycle that usually begins in late November monsoonal rains are frequent, often occurring daily. However, when the rains cease, usually in March, little to no rain falls until the next wet season. As a result, the lush vegetation, which is rich in grasses that grow during the wet period, becomes dry and prone to burning. Consequently, all vegetation in the region either possesses adaptation to fire or grows in niches that escape fire (e.g., rock outcrops). This unique habitat hosts a distinctive and diverse flora that is high in endemics. Several taxa of note form a diverse and morphologically distinctive group of cotton relatives (*Gossypium* L. spp.) that are endemic to the Kimberley Plateau and nearby region.

The *Gossypium* species occurring in this region, all of which are included within subgenus *Sturtia* (R. Br.) Tod., section *Grandicalyx* (Fryxell) Fryxell, are clearly adapted to this climatic regime with a number of morphological elaborations unique to the genus: (1) an herbaceous perennial growth habit in which the stems grow from the crown of a woody lignotuber, (2) a capsule whose peduncle becomes recurved shortly after anthesis such that the capsule is pendent and upon opening drops the seeds to the ground, and (3) development of an elaiosome from the seed rachis so that ants disperse the seed to underground nests when they fall to the ground,

[1] This paper is dedicated to James McD. "Mac" Stewart (1941–2012) and Lyn A. Craven (1945–2014), both of whom passed away prior to its completion. Both Mac and Lyn made major contributions to our understanding of *Gossypium* diversity and taxonomy.

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where they may escape fire or possibly predation by birds. The stems of the plants most frequently die during the dry cycle and resprout from the crown of the lignotuber at the onset of the wet cycle or following a fire. In the absence of fire, the stems of some of the more robust species may survive the dry period and regrow from lateral buds.

Based on the short branch lengths obtained in molecular analyses (Seelanan et al., 1999), speciation in *Gossypium* sect. *Grandicalyx* appears to have been rapid. Evidence to date suggests two evolutionary lineages within the section. One lineage consists mostly of the prostrate to decumbent species, whereas the second lineage contains the more upright species (Seelanan et al., 1999: fig. 6; Liu et al., 2001).

During 1981–1985, explorations for germplasm related to cotton (*Gossypium hirsutum* L.) resulted in numerous collections that led to a revision of *Gossypium* sect. *Grandicalyx* and recognition of six new species (Fryxell et al., 1992). In 1993, Wendel, Brubaker, Craven, and Fryxell undertook another expedition to areas of the Kimberley region of Western Australia not visited during previous expeditions. During this 1993 collecting expedition, a new *Gossypium* morphotype that was clearly attributable to section *Grandicalyx*, but that could not be ascribed to any of the known species, was collected from several populations.

The new morphotype possesses the diagnostic features of the *Gossypium* sect. *Grandicalyx* species: large, nearly naked seeds carrying a prominent elaiosome, white flowers with deep maroon petal spots, recurved fruit pedicels, and an underground lignotuber. Subsequent phylogenetic analyses also support its inclusion within the section (Seelanan et al., 1999; Liu et al., 2001). Unlike other species in section *Grandicalyx*, the new species possesses a distinctive raised venation on the adaxial leaf surface that imparts the appearance of an abaxial surface.

With the species described here, *Gossypium* sect. *Grandicalyx* comprises 12 species (Fryxell et al., 1992), all but one of which are endemic to the north Kimberley region of Western Australia. The geographically exceptional species is *G. cunninghamii* Tod., which occurs on the Cobourg Peninsula of the Northern Territory of Australia, approximately 500 km disjunct from other section *Grandicalyx* species. The morphology of *G. cunninghamii* is noteworthy in the context of the present article in that phylogenetic analyses (Seelenan et al., 1999; Liu et al., 2001) suggest that the closest relatives of the new species *G. anapoides* J. M. Stewart, Craven, Brubaker & Wendel are *G. cunninghamii* and *G. londonderriense* Fryxell, Craven & J. M. Stewart. Within this clade, *G. cunninghamii* and *G. anapoides* are probably sister taxa, as they share morphological features that are otherwise unique within section *Grandicalyx*, namely pinnate venation and short (up to 14 mm) petioles.

The possibility of shared ancestry between the lineage leading to modern *Gossypium anapoides* and *G. cunninghamii* is noteworthy. The latter species possesses the morphological features typical of the section, but it is unique in having sessile leaves and a cytoplasmic genome more similar to that of *G. sturtianum* J. H. Willis (subgenus *Sturtia*, section *Sturtia* (R. Br.) Tod.) than to the other species of section *Grandicalyx* (Wendel & Albert, 1992). The species described here has very short petioles but a cytoplasmic genome similar to that of the other section *Grandicalyx* species (Wendel & Albert, 1992; Seelenan et al., 1999).

Gossypium anapoides J. M. Stewart, Craven, Brubaker & Wendel, sp. nov. TYPE: Australia. Western Australia: near Cape Talbot, ca. 90 km N of Kalumburu, 13°48′S, 126°45′E, 24 May 1993, *L. A. Craven, J. M. Stewart & J. F. Wendel 9192* (holotype, CANB; isotypes, A, DNA, K, L, MEL, MO, NA, P, PERTH, WIR). Figure 1.

Haec species a speciebus omnibus ceteris *Gossypii* sect. *Grandicalycis* (Fryxell) Fryxell foliorum venis majoribus adaxialiter abaxialiterque aequaliter prominentibus atque petiolo brevi (usque ad 14 mm longo) distinguitur.

Shrubs erect, multistemmed to 1.5 m, persisting in absence of fire and regenerating from a basal crown following fire or severe drought; stems appearing glabrous but with scattered, minute stellate hairs, denser around leaf attachments and on apical buds; black punctae (lysigenous cavities, or "gossypol glands") abundant, more apparent in younger stems than in older stems due to bark pigmentation. Leaves alternate and in vivo often ascending and partially encircling stem, leaf size typically decreasing in size toward apex of each stem, coriaceous; stipules 1–2 mm, caducous. Lamina ovate to orbicular, as broad as long (< 7 cm) especially in proximal leaves; adaxial surface with abundant minute stellate hairs, abaxial surface and margin nearly glabrous; apex variously obtuse, apiculate, cuspidate, or acuminate with base mostly cuneate or sometimes rounded to attenuate; margin entire with an occasional minute stellate hair; black punctae numerous throughout; trichomes minute, pigmented, globose, claviform, or linear, common, more so adaxially, especially near base of lamina; nectary 8–12 mm, linear, positioned abaxially on



Figure 1. Sheet 1 of the holotype of *Gossypium anapoides* J. M. Stewart, Craven, Brubaker & Wendel from *L. A. Craven, J. M. Stewart & J. F. Wendel 9192* (CANB).

midvein approximately 5 mm from base of leaf; major veins equally raised abaxially and adaxially; petioles ca. 10 mm (5–14 mm), 1/10 to 1/5 the length of lamina in older leaves; sepals basally connate into a cup, 4–7 mm in length, lobes acuminate to linear, equal to or slightly longer (4–8 mm) than cup, sinuses between lobes broadly rounded, trichomes numerous on the adaxial (inner) surface of lobes, black punctae

numerous throughout and 2 to 3 times larger than the foliar punctae; petals pink to red where exposed in bud, white with basal burgundy spots when open, senescing to pink within 12 hours of anthesis, 45–65 mm, basal spots 10–15 mm, black punctae scattered throughout, stellate trichomes numerous, the longest on basal portions of petal margins; staminal column white, epunctate; filaments 1–1.5 mm; anthers occasionally with one to several black punctae, pollen cream-colored at anthesis and drying to yellow; style clavate, 15–22 mm, extending 6–8 mm beyond staminal column, with scattered black punctae; stigmata fused and decurrent on style; epicalyx lobes sharply reflexed in fruit, with 4–5 mm acute lobes, basally 1–1.5 mm wide, usually entire, rarely with 1 to 2 teeth, with numerous pigmented trichomes on the adaxial surface; epicalyx nectaries absent or insignificant and subtending lobes; capsules globose, apiculate, 8–10 mm diam., triloculate, with 1(2) seeds per locule, capsule walls densely punctate, with individual punctae ca. twice as large as those of calyx; seeds brown, with a thin covering of short (< 1 mm) solitary trichomes, slightly longer than wide, elaiosome 1/2 to 3/4 of seed length.

For additional phylogenetic information on the new species described here, see *Gossypium* sp. A; Seelanan et al., Syst. Bot. 24: 184, 187 (1999); and *Gossypium species novum*; Liu et al., Amer. J. Bot. 88: 94 (2001).

Distribution and habitat. *Gossypium anapoides* apparently is restricted to a narrow coastal strip on the east side of Napier Broome Bay between ca. 30 and 90 km to the north of Kalumburu, Western Australia. The climate is one of a distinct monsoonal season followed by a prolonged dry period. Plants are generally associated with relatively deep sandy soils in coastal flats and adjacent broken sandstone catchments. Specific habitats where plants have been recorded by collectors include (1) open mixed woodland near the beach, growing on lateritic gray-brown sandy loam; (2) sandstone spinifex and margins thereof; (3) deeper sands (locally common) and also *Eucalyptus miniata* A. Cunn. ex Schauer woodland inland from sandstone spinifex; (4) eucalypt and *Sorghum* Moench savannah grassland on plain with black gravel strew, probably underlain with sandstone or laterite; and (5) rocky slopes ca. 50 m behind the beach in open eucalypt woodland with understory of coarse grass.

IUCN Red List category. The conservation status of *Gossypium anapoides* is assessed as Data Deficient, or DD, according to IUCN Red List criteria (IUCN, 2001).

Etymology. The epithet is arbitrarily derived from the Greek combining forms *ana-* (back or bottom), *apo-* (front or top), and *-eidos* (resemblance) and refers to the leaves being of quite similar appearance on each surface; that is, they approach being isobilateral, being distinguishable only by a small nectary on the main vein of the abaxial side of the leaf. The leaves of all other species of section *Grandicalyx* are distinctly dorsiventral.

Discussion. The lengths of the inflorescence branches are related to the growth cycle. The peduncle plus pedicel may exceed 50 mm early in the cycle, but branches developing later in the reproductive season are shorter, generally ranging from 25 to 45 mm. The articulation between the peduncle and pedicel is ca. half of their combined length and is subtended by a small bract (to 3 mm in length), which in late-developing buds is further reduced or may be wanting. The elaiosome arises as an elaboration of the rachis and is fleshy and white on fresh seed, becoming shriveled and brownish when dried.

Paratypes. AUSTRALIA. **Western Australia:** E of Cape Talbot, ca. 90 km N of Kalumburu, 13°46′S, 126°49′E, 24 May 1993, *Craven, Stewart & Wendel 9193* (AD, CANB, DNA, NA, PERTH, WIR); near Curran Point, ca. 80 km N of Kalumburu, 13°54′S, 126°48′E, 24 May 1993, *Craven, Stewart & Wendel 9188* (A, BRI, CANB, DNA, L, MEL, NA, NSW, P, PERTH), *Craven, Stewart & Wendel 9191* (CANB, DNA, NA, PERTH); ca. 2 km S of Honeymoon Bay, ca. 35 km N of Kalumburu on track to Pago Pago, 14°07′02″S, 126°40′47″E, 5 June 1996, *Mitchell 4432* (CANB, PERTH not seen); Honeymoon Beach, betw. Bluff Point & Tate Point, ca. 30 km N of Kalumburu, 28 July 1995, *Fraser s.n.* (CANB).

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Rubiacearum Americanarum Magna Hama XXXIII: The New Group *Palicourea* sect. *Didymocarpae* with Four New Species and Two New Subspecies (Palicoureeae)

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Abstract. Morphological and molecular studies show that many of the species classified in *Psychotria* L. subg. *Heteropsychotria* Steyerm. belong to *Palicourea* Aubl. Accordingly, most of the species of *Psychotria* sect. *Didymocarpos* Steyerm. plus several additional species are transferred to the new *Palicourea* sect. *Didymocarpae* C. M. Taylor; however, the type species of Steyermark's section, *Psychotria bahiensis* DC., does not have the diagnostic fruit and pyrene morphology and is excluded. *Palicourea* sect. *Didymocarpae* includes 17 species found from central Mexico and the Antilles to northeastern South America and Bolivia and is diagnosed by its didymous fruits with two subglobose pyrenes that are smooth abaxially and have thin-textured walls. New combinations are made: *Palicourea boraginoides* (Dwyer) C. M. Taylor is based on *Psychotria acuminata* Benth. subsp. *boraginoides* Dwyer; *Palicourea candelabrum* (Standl.) C. M. Taylor is based on *Psychotria candelabrum* Standl.; *Palicourea ceratantha* (Standl.) C. M. Taylor is based on *Psychotria ceratantha* Standl.; *Palicourea compta* (Standl.) C. M. Taylor is based on *Psychotria compta* Standl.; *Palicourea cuspidata* (Bredem. ex Schult.) C. M. Taylor is based on *Psychotria cuspidata* Bredem. ex Schult.; *Palicourea cuspidulata* (K. Krause) C. M. Taylor is based on *Cephaelis cuspidulata* K. Krause; *Palicourea huampamiensis* (C. M. Taylor) C. M. Taylor is based on *Psychotria huampamiensis* C. M. Taylor; *Palicourea jauaensis* (Steyerm.) C. M. Taylor is based on *Psychotria jauaensis* Steyerm.; *Palicourea pandensis* (Standl.) C. M. Taylor is based on *Psychotria pandensis* Standl.; *Palicourea rhodothamna* (Standl.) C. M. Taylor is based on *Psychotria rhodothamna* Standl.; *Palicourea spicata* (Kuntze) C. M. Taylor is based on *Uragoga spicata* Kuntze, a replacement name for the illegitimate name *Psychotria spicata* Müll. Arg.; and *Palicourea subcuspidata* (Müll. Arg.) C. M. Taylor is based on *Psychotria subcuspidata* Müll. Arg. and includes *Psychotria cornigera* Benth., recognized as a separate species from *Psychotria bahiensis*. Flowers are described for the first time for *Palicourea candelabrum*, and the circumscriptions of *Palicourea acuminata* (Benth.) Borhidi, *Palicourea compta*, and *Palicourea rhodothamna* are revised. The new species *Palicourea andina* C. M. Taylor is found in western Panama and the Andes of Colombia, Ecuador, Peru, and Bolivia and distinguished from *Palicourea cuspidata* by its corollas that lack abaxial horns on the lobes; two subspecies are separated, *Palicourea andina* subsp. *panamensis* C. M. Taylor in Panama and the typical subspecies in the Andes. The new species *Palicourea diminuta* C. M. Taylor of the Guianas and adjacent northeastern Brazil is distinguished by its small straight corollas. The new species *Palicourea maddidiensis* C. M. Taylor of southern Peru and Bolivia differs from *Palicourea acuminata* in its corolla lobes with small abaxial projections and its habitat at higher elevations. The new species *Palicourea sanluisensis* C. M. Taylor of northwestern Colombia differs from *Palicourea acuminata* in its stiff-textured leaves, corollas with small abaxial thickenings on the lobes, and habitat on sandstone substrates. The new subspecies *Palicourea cuspidata* subsp. *occidentalis* C. M. Taylor is found in mountain forests of Colombia and northern Ecuador and is disjunct from the typical subspecies. The names *Cephaelis cuspidulata* and *Declieuxia psychotrioides* DC. are lectotypified.

Key words: Bolivia, Brazil, *Cephaelis*, Colombia, Ecuador, French Guiana, Guyana, IUCN Red List, *Palicourea*, Palicoureeae, Peru, *Psychotria*, Psychotrieae, Rubiaceae, Suriname.

Palicourea Aubl. (Rubiaceae, Palicoureeae or Psychotrieae s. lat.; abbreviated here as "*Pal.*") comprises several hundred Neotropical species of shrubs and small trees with persistent stipules, animal-pollinated flowers, and blue to purple-black, fleshy, drupaceous fruits (Taylor, 1996, 1997a). This genus has long been considered closely related to the pantropical *Psychotria* L. (abbreviated here as "*Psy.*"), and these genera were long classified together in the tribe Psychotrieae. However, recent molecular analyses show that the broadly circumscribed tribe Psychotrieae included two distinct

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clades or evolutionary groups, one comprising *Psychotria* and the other composed of various genera including *Palicourea* (Andersson, 2002; Robbrecht & Manen, 2006; Razafimandimbison et al., 2014). These groups have been separated taxonomically by some recent authors, as informal groups (Andersson, 2002) or as two tribes, Psychotrieae s. str. and Palicoureeae (Robbrecht & Manen, 2006; Razafimandimbison et al., 2014). As the separation between *Psychotria* and *Palicourea* has been clarified, morphological (Taylor, 1996) and molecular (Andersson & Rova, 1999; Nepokroeff et al., 1999; Robbrecht & Manen, 2006; Razafimandimbison et al., 2008, 2014; Paul et al., 2009; Sedio et al., 2013) studies have confirmed also that the Neotropical species generally classified in *Psychotria* are a heterogeneous group. Some of these species are correctly classified in *Psychotria*, but most of them belong to Palicoureeae and, within this, to several distinct genera. Notably, most of the species of the Neotropical *Psychotria* subg. *Heteropsychotria* Steyerm. do belong to one evolutionary group, which also includes the species that have been classified in *Palicourea* (Taylor, 1996; Paul et al., 2009; Sedio et al., 2013). This combined Neotropical group takes the name *Palicourea* and is estimated to include about 600 species. This present article continues the expansion of the circumscription of *Palicourea* (Taylor et al., 2010) via transfer from *Psychotria* to *Palicourea* of the incorrectly classified species. The species included up to now in *Palicourea* are classified in two subgenera and nine sections (Taylor, 1997a; Taylor et al., 2010), and a new section is added here.

Palicourea was long separated from *Psychotria* subg. *Heteropsychotria* based on corolla characters that are related to pollination mode (Steyermark, 1972; Taylor, 1996, 1997a); *Palicourea* and *Psychotria* subg. *Heteropsychotria* are not distinguishable vegetatively or in fruit (Taylor, 1996). In this prior taxonomy, *Palicourea* included plants adapted for hummingbird pollination, with flowers that are odorless, pedicellate, and well separated from each other on lax inflorescences; brightly colored inflorescences and flowers; and relatively large corollas with well-developed, often curved tubes that are swollen at the base, with this basal portion containing appreciable quantities of nectar that is protected from insects by a ring of stiff trichomes. In contrast, *Psychotria* subg. *Heteropsychotria* included presumably insect-pollinated species, with flowers that are sessile or subsessile, partially separated to variously grouped, and fragrant; green to white or pale yellow inflorescence axes and flowers; and smaller corollas generally with straight bases and short tubes that allow small insects to access the nectar. However, there is actually extensive variation in corolla form within both *Palicourea* and *Psychotria* subg. *Heteropsychotria* (e.g., Taylor et al., 2004), and the classic flower and inflorescence characters do not separate two morphologically or evolutionarily distinct groups of species. Recent molecular analyses have demonstrated that inflorescence arrangement and pollination mode, with its corresponding adaptations, have changed repeatedly in homoplasious fashion within various Rubiaceae genera (e.g., Nepokroeff et al., 1999; Malcomber & Taylor, 2009; Mouly et al., 2009), and the molecular data available show a similar pattern for the plants studied here (Paul et al., 2009; Sedio et al., 2013). The combined group, *Palicourea* plus most of the species of *Psychotria* subg. *Heteropsychotria*, is morphologically well delimited by vegetative and fruit characters and has support from molecular data, and now needs taxonomic and nomenclatural review of the component species.

Palicourea in this new, broadened circumscription is characterized within Palicoureeae by its persistent bilobed stipules; terminal, laxly thyrsiform to subcapitate, bracteate to ebracteate, green to brightly colored inflorescences; generally 5-merous, sessile to pedicellate flowers; generally inaperturate pollen with thin sexine (Johansson, 1992); and usually blue to purple-black succulent or fleshy fruits (Taylor, 1996, 1997a; Taylor et al., 2010). In this broadened circumscription the name *Psychotria* subg. *Heteropsychotria* is a synonym of *Palicourea*, but the transfer of its species to *Palicourea* is complicated. *Psychotria* subg. *Heteropsychotria* was circumscribed based on corolla characters that are widespread and apparently ancestral within its tribe so it included a heterogeneous assemblage of species. Many of its species have recently been separated into other genera: *Notopleura* (Benth.) Bremek. (Taylor, 2001a), *Ronabea* Aubl. (Taylor, 2004), *Margaritopsis* C. Wright (Taylor, 2005), *Coccochondra* Rauschert (Taylor, 2011), and *Carapichea* Aubl. (Taylor & Gereau, 2013). The remaining species of *Psychotria* subg. *Heteropsychotria* apparently belong to *Palicourea*, but some of them are related to other species classified in this subgenus while some are more closely related to species always classified in *Palicourea*. The existing infrageneric classifications of *Palicourea* (Taylor, 1997a) and for the species of *Psychotria* subg. *Heteropsychotria* (Mueller, 1881; Steyermark, 1972) provide a framework for combining these groups but were not comprehensive. *Cephaelis* Sw. was previously synonymized with

Psychotria subg. *Heteropsychotria* (Steyermark, 1972) and is now a synonym of *Palicourea* (Taylor & Gereau, 2013); however, numerous species were incorrectly classified in *Cephaelis* and do not transfer to *Palicourea* (Taylor & Gereau, 2013).

The Species of *Psychotria* sect. *Didymocarpos*

In his study of *Psychotria* in northeastern South America, Steyermark (1972: 516–524) included five species in his *Psychotria* sect. *Didymocarpos* Steyerm.: *Psy. bahiensis* DC., *Psy. cuspidata* Bredem. ex Schult., *Psy. acuminata* Benth., *Psy. ceratantha* Standl., and *Psy. jauaensis* Steyerm. He distinguished this section by its didymous fruits that are narrowed at the connection between the two pyrenes, and the subglobose, abaxially (i.e., dorsally) smooth to weakly ridged form of these pyrenes: "[b]acca didyma globosa, umbilicata, pyrenis dorso subteretibus convexis sublaeviter vel leviter costatis" (Steyermark, 1972: 516). Mueller's (1881) classification of *Psychotria* in Brazil was also regional and has little taxonomic overlap with Steyermark's. Two of the species Steyermark included in this section, *Psy. bahiensis* and *Psy. cuspidata*, were also treated by Mueller (1881) who considered them conspecific. Mueller grouped these with several Brazilian species that have differently shaped pyrenes and are here considered not closely related. Mueller distinguished his infrageneric taxa of *Psychotria* largely based on the branching pattern and degree of development of the bracts of the inflorescences along with some leaf characters, and in general most of Mueller's classification is not congruent with Steyermark's classification.

Steyermark designated *Psychotria bahiensis* as the type of *Psychotria* sect. *Didymocarpos* and recognized two varieties of this species: *Psy. bahiensis* var. *bahiensis* and *Psy. bahiensis* var. *cornigera* (Benth.) Steyerm. His application of the name *Psy. bahiensis* followed that of Bentham (1841: 227), who considered *Psy. cornigera* Benth. closely related to *Psy. bahiensis* (this may have been due at least in part to frequent misidentifications of plants of *Psy. cornigera* as *Psy. bahiensis*). Mueller (1881: 287–288) in turn considered *Psy. bahiensis* a synonym of a broadly circumscribed *Psy. cuspidata*, applying the name *Psy. cuspidata* to plants treated by later authors variously as *Psy. bahiensis*, *Psy. cornigera*, *Psy. cuspidata*, and *Psy. acuminata* (Taylor et al., 2004). Steyermark separated his two varieties of *Psy. bahiensis* based on corolla size, degree of development of the abaxial protuberances on the corolla lobes, peduncle length, inflorescence size, petiole length, and leaf blade width. The plants he included in *Psy. bahiensis* var. *cornigera* correspond to those treated by Taylor et al. as *Psy. cornigera*, while his *Psy. bahiensis* var. *bahiensis* included two disjunct groups of plants, one group in eastern Brazil that matches the type of *Psy. bahiensis*, and the other in the Guianas, Venezuela, and adjacent northern Roraima and differing markedly in fruit form from the Brazilian plants. The plants of the Guianas region have didymous fruits with subglobose smooth pyrenes, while the plants from Bahia have generally ellipsoid fruits with the pyrenes hemispherical to weakly rounded, abaxially with well-developed ribs and the surface between the ribs markedly pitted, and with bony external walls (*R. M. Harley 17405*, *17610*, both at MO). Although the complete fruits of the plants from Bahia do have a depression on their sides where the two pyrenes meet and thus a weakly didymous form, their overall form and their pyrenes are very different from those of the other plants Steyermark included in *Psy. bahiensis* as well as the other species of *Psychotria* sect. *Didymocarpos*, which all have subglobose, abaxially smooth pyrenes with thin-textured walls. Thus, *Psy. bahiensis* does not agree morphologically with the other species included in *Psychotria* sect. *Didymocarpos*. The plants from the Guianas, Venezuela, and adjacent Brazil that Steyermark included in *Psy. bahiensis* var. *bahiensis* do share fruit and pyrene form with the other species he included there, but represent a heterogeneous group of plants that are separated here into several species. This taxonomic problem in the identity and circumscription of *Psy. bahiensis* dates at least back to the works of Mueller (1881), and has generated extensive confusion about the identities of several of the species studied here and obscured the relationships among the species of Steyermark's *Psychotria* sect. *Didymocarpos* (e.g., Bremekamp, 1934; Steyermark, 1972, 1974). These plants were not considered conspecific by all authors though (e.g., Standley, 1930, 1936).

The New Group *Palicourea* sect. *Didymocarpae*

All of the species of *Psychotria* sect. *Didymocarpos* have the characteristics of *Palicourea* in the expanded circumscription recognized here (Taylor et al., 2010) and transfer to this genus. All of these species except *Psy. bahiensis* also share distinctive characters of the fruits and pyrenes, and are included in a newly described section, *Palicourea* sect. *Didymocarpae* C. M. Taylor. Molecular analyses (Paul et al., 2009) have included several of these species, which were grouped on a single well-supported clade. Molecular analyses have also included *Psy. bahiensis*, but the identifications of specimens analyzed under this name are problematic.

Palicourea sect. *Didymocarpae* belongs to *Palicourea* subg. *Palicourea* and does not correspond to any of the infrageneric taxa recognized by Taylor (1997a). This new section differs from *Psychotria* sect. *Didymocarpos* in its narrower morphological characterization, i.e., excluding the abaxially ribbed pyrenes of *Psy. bahiensis*; exclusion of the type species of that section; and addition of several species and the resulting change of its center of species diversity to western South America.

Palicourea sect. *Didymocarpae* includes 17 species, four newly described here, and is diagnosed within *Palicourea* by its didymous whole fruits, with the dried or immature fruit narrowed markedly around its circumference at the union of the two subglobose pyrenes (Fig. 1G), and its nearly subglobose pyrenes with the abaxial surface smooth throughout, the adaxial face much less than half the overall pyrene diameter, and the external walls quite thin-textured, generally cartilaginous to chartaceous. Based on these characters, *Psychotria bahiensis* is not included in this group, and, consequently, this new *Palicourea* section is distinct nomenclaturally as well as taxonomically from Steyermark's *Psychotria* sect. *Didymocarpos*. Essentially, the same sectional epithet is adopted here because it is a good descriptive name, and the diagnostic characters and species composition of *Palicourea* sect. *Didymocarpae* are largely the same as for Steyermark's *Psychotria* section. However, the form of the sectional epithet used here is a plural Latinized adjective as recommended by Nicolson (1986).

In addition to these fruit shape and pyrene features, *Palicourea* sect. *Didymocarpae* is characterized by its stipules that are united at least shortly around the stem, with a truncate to concave sheath portion and two triangular lobes on each interpetiolar side; generally thin-textured leaves without intersecondary veins or with these few and rather short; inflorescences with various arrangements but the bracts usually few and scattered on the higher-order axes, though occasionally well developed; relatively short calyx limbs, 0.1–2 mm long; salverform to funnelform, white, yellow, orange, pink, or violet corollas with a swollen and often bent to gibbous base, usually curved tubes that spread similarly to the lobes in the very top portion, and smooth lobes or these more often thickened to horned abaxially; infructescence axes that usually become markedly thickened as the fruits mature, an unusual feature in *Palicourea*; and spongy blue, white, or blue-black fruits. Species of this group that have been analyzed also share unusual secondary compounds (Berger et al., 2012).

Several species are here added to Steyermark's (1972) original set, most from outside his study region or newly described. One species added here was studied by Steyermark but not included in the group, *Psychotria spiciflora* Standl. Steyermark classified this species in *Psychotria* sect. *Chytropsia* (Bremek.) Steyerm., which included a heterogeneous group of species (Taylor, 2005). Most of them are now included in *Margaritopsis*, but *Psy. spiciflora* was excluded from that genus and suggested to belong to *Psychotria* sect. *Didymocarpos* by Taylor based on its persistent stipules that remain membranaceous, its fruits that are purplish blue at maturity, and its subglobose pyrenes with rather thin walls; in contrast to stipules that become fragmented and indurated with age, red fruits, and hemispherical pyrenes with coriaceous to bony walls in *Margaritopsis*. Piesschaert also suggested (2001: 257–258) that *Psy. spiciflora* belonged to *Psychotria* sect. *Didymocarpos* based on detailed studies of pyrene form. Piesschaert mentioned some other species that may belong to this section, but those other species have ellipsoid to subglobose fruits without a didymous form, pyrenes with a broad adaxial face and bony walls, leaves with regularly developed intersecondary veins, regularly developed and distributed inflorescence bracts, and corollas with generally straight tubes that do not flare at the top and thus do not agree with the morphological characterization of *Palicourea* sect. *Didymocarpae*.

One species was described with the characteristic fruit form of *Palicourea* sect. *Didymocarpae*, but the protologue information is not adequate to determine which species this name applies to in the current classification, and its type material needs further study. This name is:

Ronabea didymocarpos A. Rich. in DC., Prodr. 4: 504. 1830. *Uragoga didymocarpos* (A. Rich.) M. Gómez, Anales Soc. Esp. Hist. Nat. 23: 294. 1894. *Psychotria didymocarpos* (A. Rich.) Lemée, Fl. Guyane Franc. 3: 564. 1954. *Psychotria didymocarpos* (A. Rich.) Borhidi, Acta Bot. Hung. 37: 86. 1992, comb. superfl. TYPE: French Guiana, *Richard s.n.* (holotype, P not seen).

De Candolle's protologue was taken directly from Richard's work (Richard, 1830) and says only "foliis elliptico-acuminatus subpetiolatis, stipulis intrapetiolaribus connatis truncatis bisetosis, floribus in cymam terminalem dispositis, fructibus didymis puncto terminali umbilicatis" (de Candolle, 1830: 504). De Candolle noted that most likely this species did not belong to *Ronabea*, and it was later excluded from that genus by Taylor (2004: 38) based on its bilobed stipules and terminal inflorescences (vs. triangular stipules and axillary inflorescences in

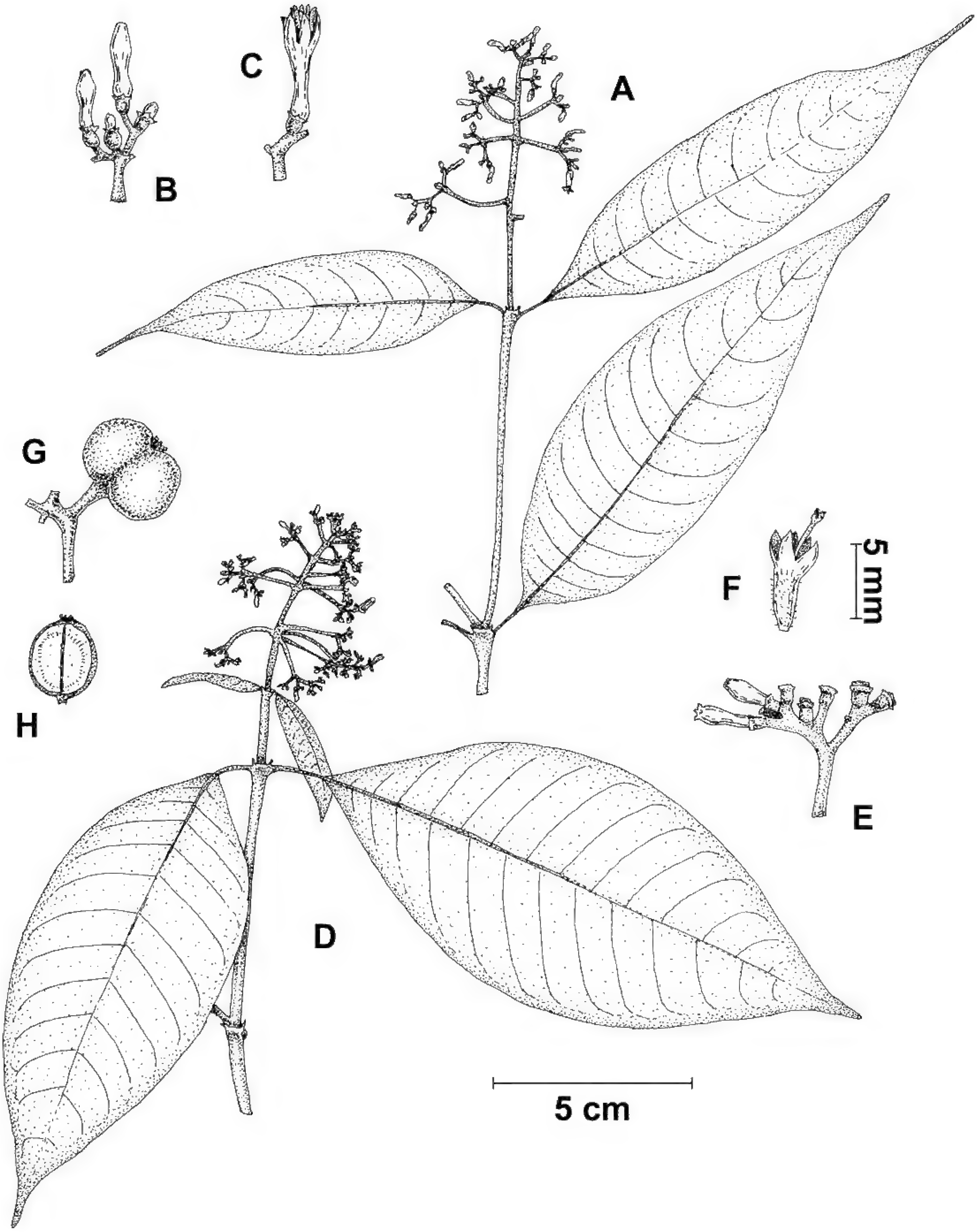


Figure 1. A–C. *Palicourea andina* C. M. Taylor, based on *D. Wolff 45* (MO). —A. Flowering branch. —B. Portion of inflorescence with four flower buds. —C. Mature flower bud, just before anthesis. D–H. *Palicourea sanluisensis* C. M. Taylor. —D. Flowering branch. —E. Portion of inflorescence with two flower buds and five flowers from which corollas have fallen. —F. Flower bud partially opened, dissected off inflorescence, with corolla, style, and immature stigmas. —G. Portion of infructescence with one fruit. —H. Cross-section of dried immature fruit, showing pyrene adaxial face. D–F based on *D. Cárdenas & J. G. Ramirez 2736*; G, H based on *C. Díaz et al. 10772* (MO). A, D to same 5-cm scale; B, C, E–H to same 5-mm scale.

Ronabea). Taylor incorrectly stated there that this name is a synonym of "*Psychotria cornigera* DC." but intended to cite the name *Psy. cornigera* Benth. Steyermark (1972: 516–517) treated *R. didymocarpos* twice in his taxonomy of *Psychotria* sect. *Didymocarpos*, as an unassigned name at the sectional level and simultaneously as a synonym of *Psy. bahiensis* var. *bahiensis*. As noted above, the name *Psy. bahiensis* is here applied only to plants from eastern Brazil, so the name *R. didymocarpos* corresponds to a species from French Guiana; however, the limited description of *R. didymocarpos* applies equally well to all of the species of *Palicourea* sect. *Didymocarpae* known from there. The name *R. didymocarpos* has also been applied to Cuban plants (Liogier, 1962: 105), and a specimen from Cuba identified apparently by Richard as *R. didymocarpos* has sometimes been erroneously regarded as the type of this name (*de la Sagra s.n.*, P not seen, P as F neg. #37248 at MO). However, this Cuban specimen is not the type and represents *Pal. acuminata* (Benth.) Borhidi. The name *R. didymocarpos* has nomenclatural priority over any of the other names for species of this *Palicourea* section known from the Guianas, once its identity is clarified.

The species of *Palicourea* sect. *Didymocarpae* range from southern Mexico and Cuba through the Amazon basin to Bolivia and across the Guianas to northern and central Brazil, in wet forest vegetation. Most of its species are found in the western Amazon basin, and most species are in the lowlands but several are found in montane habitats in the Andes and the Guayana Highlands. Most of the species seem to be generalists with regard to substrate, but a few may be specialized; in particular, *Pal. ceratantha* (Standl.) C. M. Taylor and *Pal. jauaensis* (Steyerm.) C. M. Taylor are known only from sandstone substrates, and *Pal. compta* (Standl.) C. M. Taylor and *Pal. sanluisensis* C. M. Taylor are usually or perhaps always collected on sandy or sandstone-derived substrates.

Morphological Notes on *Palicourea* sect. *Didymocarpae*

The features that specifically diagnose and characterize this section are outlined in the previous section.

A number of the species of *Palicourea* sect. *Didymocarpae* often show an unusual, apparently dichotomous branching pattern, with two stems of more or less equal size arising from a node that does not also have an inflorescence or infructescence (Figs. 1, 2). These branches seem to arise from more or less equal development at the nodes of the terminal bud and one axillary bud, rather than two axillary buds usual in *Palicourea*. The dried specimens of many species have a characteristic reddish purple drying color (e.g., *Meier 7841*, MO, color image at <http://www.tropicos.org/Image/100167532>). Most of these species are characterized by rather prolonged acuminate leaf tips, with the tip portion frequently 20%–25% of the length of the leaf blade. The leaves often have no mite domatia, but sometimes have shallow, glabrescent to usually pubescent domatia on the lower surface in the axils of the secondary veins as in most species of *Palicourea*. Many of the species lack intersecondary veins or have only a few that are weakly developed; however, intersecondary veins are regularly developed in a few species of this group (e.g., *Pal. candelabrum* (Standl.) C. M. Taylor; intersecondary veins are produced from the costa between pairs of secondary veins and are distinct from tertiary and higher-order venation).

The inflorescences are terminal and only infrequently displaced to pseudoaxillary as the fruits develop, rather than regularly overtopped by subsequent stem growth as in most species of *Palicourea*. The inflorescences vary from subcapitate to lax and are branched to several orders; however, a few species have cylindrical spiciform inflorescences with the axes reduced or very short (e.g., *Pal. huampamiensis* (C. M. Taylor) C. M. Taylor, *Pal. spicata* (Kuntze) C. M. Taylor). In most species, the infructescence axes and pedicels elongate as the fruits develop, so the inflorescence may be short and congested when flowering begins, but the infructescences are markedly larger and laxer. The inflorescence axes and bracts are characteristically green, white, or yellow during flowering and then become flushed or darkened with purple and often thickened and fleshy as the fruits mature. This developmental change in inflorescence form, together with the separation of some species only by flower characters, makes identification of fruiting specimens in many cases provisional. Most of the species of *Palicourea* sect. *Didymocarpae* have only a few small inflorescence bracts that are distributed irregularly along the axes and pedicels, rather than well-developed bracts that are regularly borne at branching nodes of the inflorescence as in most species of *Palicourea*. Small differences in the degree of bract development have been considered to distinguish individual species of *Psychotria* and *Palicourea*, in particular by Steyermark (1972, 1974), but with more specimens now available, bract size is documented to vary continuously from minute to 2 mm long in most of the species of this group. One species, *Pal. pandensis* (Standl.) C. M. Taylor, does have numerous well-developed bracts, however. The flowers of these species are generally

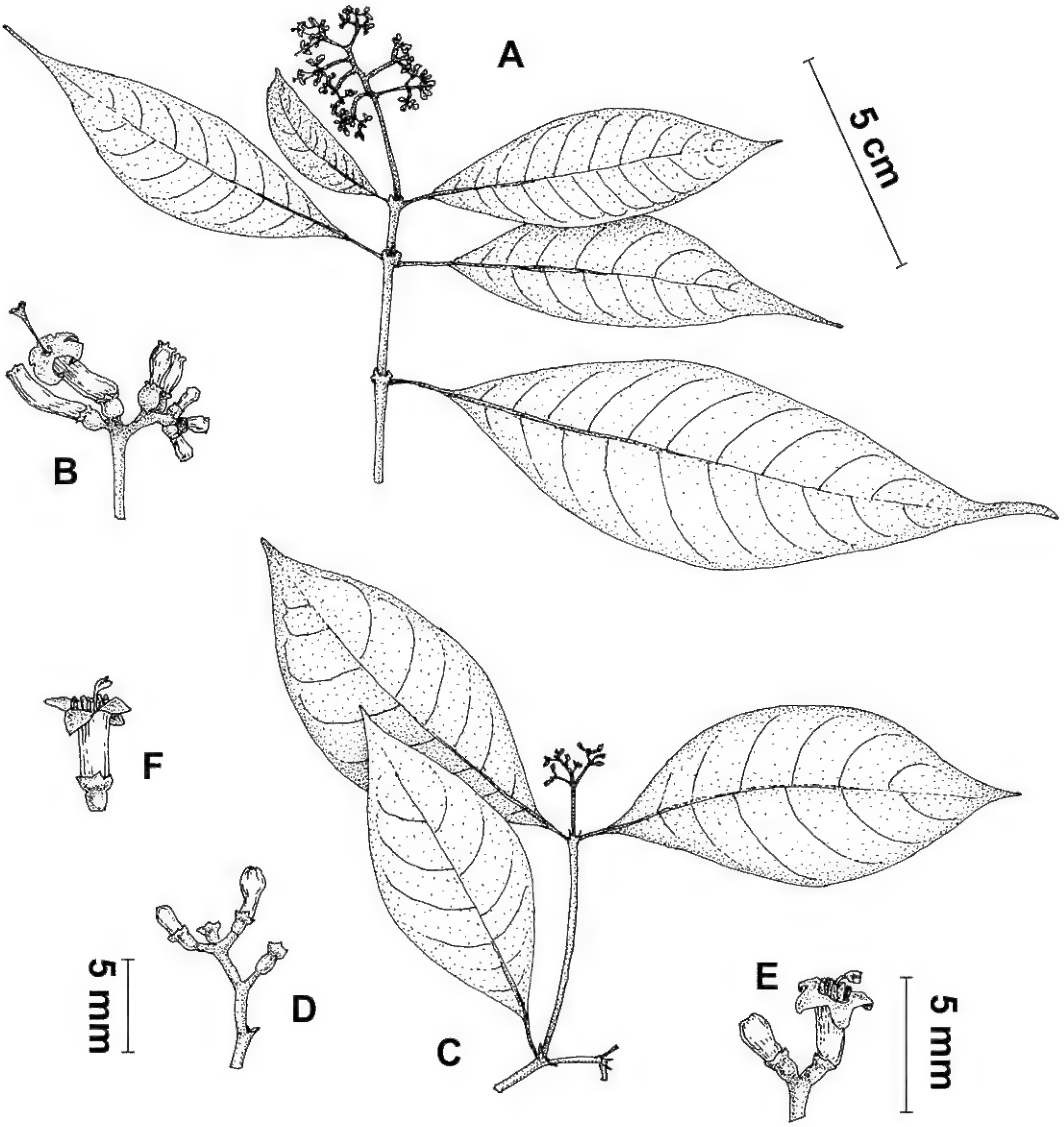


Figure 2. A, B. *Palicourea madidiensis* C. M. Taylor, based on *L. Cayola et al. 2453* (MO). —A. Flowering branch. —B. Portion of inflorescence with one flower at anthesis and five flower buds. C–F. *Palicourea diminuta* C. M. Taylor. —C. Flowering branch. —D. Portion of inflorescence with two flower buds and two flowers from which corollas have fallen. —E. Portion of inflorescence with one flower at anthesis. —F. Flower at anthesis. C–E, based on *J. J. Pipoly & H. Lall 8054* (MO); F, based on *M. J. Jansen-Jacobs et al. 6345* (MO). A, C to same 5-mm scale; B, D–F to same 5-mm scale.

arranged in dichasial cymes, and, as in many species of *Psychotria* and *Palicourea*, whether a flower is sessile on a short inflorescence axis or is borne on its own pedicel can be subject to interpretation.

The flowers of several species are clearly distylous, as in most of the species of *Palicourea* and Palicoureeae. A few species studied here are documented by only one or a few flowering specimens and have flowers similar to one form of distylous species, either long-styled or short-styled, and probably are distylous, but a monomorphic condition cannot yet be ruled out for these. The calyx lobes, corolla lobes, and stamens are basically five in all of these species; as in many species of *Palicourea*, occasionally one or a few flowers on an inflorescence are 4-merous in the well-documented species, and this variation can probably be expected in all of the species.

The corollas of the species of *Palicourea* sect. *Didymocarpae* are characteristically bent and gibbous

at the base, except in *Pal. diminuta* C. M. Taylor, where they are apparently straight. This corolla form of *Palicourea* species often varies within an inflorescence, with the flowers near the central parts often nearly straight while the outer and lower flowers are more strongly bent apparently to provide better access for pollinators (pers. obs.), and this arrangement is seen in species of this group. The corollas of most if not all these species are a little unusual in having not only the lobes spreading widely but also the upper portion of the corolla tube (Fig. 2E); in contrast, the corollas of most species of *Palicourea* at anthesis have the lobes spreading at ca. 90° or more from the corolla tube, but the tube itself is cylindrical all the way to its top. A peculiar corolla character in several species of this new section is the well-developed linear projections or horns borne on the abaxial side of the lobes (Figs. 1E, 2B). These are particularly well developed in *Pal. cuspidata* (Bredem. ex Schult.) C. M. Taylor, *Pal. cuspidulata* (K. Krause) C. M. Taylor, *Pal. subcuspidata* (Müll. Arg.) C. M. Taylor, *Pal. pandensis*, and *Pal. jauaensis*. Well-developed projections or horns on the corolla lobes are found in various species of Rubiaceae and notably in many Palicoureeae, including *Palicourea* (Taylor, 1997a), *Notopleura* (Taylor, 2001a), and *Carapichea* (Taylor & Gereau, 2013); their function is unknown. These corolla horns vary in size within an individual species, and some species show variation in development of these structures among individual plants or developmental stages on a single plant. Sometimes these projections are evident on the corolla lobes in bud but become reduced as the corolla reaches anthesis.

Several distylous species of *Palicourea* sect. *Didymocarpae* are unusual in having stamens with well-developed filaments that are inserted near or a little above the middle of the corolla tube in both long-styled and short-styled flowers, with the anthers partially to fully exserted in both forms. This differs from the stamen arrangement in most species of *Palicourea*, which have subsessile anthers positioned near the middle of the corolla tube in long-styled flowers and partially exserted anthers on short filaments inserted in the upper part of the corolla tube in short-styled flowers. The stigmas of the species of this group are similar to those of other distylous *Palicourea*, larger and positioned near the middle of the corolla tube in the short-styled form and shorter and exserted in the long-styled form. Pollen of several of these species was studied by Johansson (1992), who included them all in his group XXI. This group was characterized by inaperturate pollen with thin sexine, and included species of *Palicourea*, *Psychotria* subg. *Heteropsychotria*, *Carapichea*, and *Notopleura*. Johansson studied four species now included in *Palicourea* sect. *Didymocarpae*: *Psy. acuminata*, *Psy. ceratantha*, *Psy. cuspidata*, and *Psy. spiciflora*. He also studied *Psy. bahiensis*, but the identity of his material according to the taxonomy in this article has not been confirmed.

The fruits of the species of *Palicourea* sect. *Didymocarpae* are generally spongy (rather than juicy) at maturity and blue, purple, or white. The fruits of these species are unusual in *Palicourea* in being rounded rather than laterally flattened and are typically wider than long because of the subglobose shape of the pyrenes (Fig. 1G). Some species, or perhaps individual plants, apparently produce fruits of different colors at maturity, similarly to a few species of Rubiaceae, e.g., *Gonzalagunia spicata* (Lam.) M. Gómez and *Psychotria deflexa* DC. The pyrenes have a preformed germination slit (PGS) in the form of a longitudinal opening along the narrow adaxial (i.e., ventral) face, or some apparently lack PGSs (Piesschaert, 2001).

Methods

This work is based on standard herbarium techniques. Additional information, including detailed specimen data, high-resolution scans of representative specimens of most of these species, and additional commentary on their circumscription and recognition, is available online in the TROPICOS® database (<http://www.tropicos.org/>) and its Rubiaceae Project (<http://www.tropicos.org/Project/Rubiaceae>). The species treated here are arranged in alphabetical order and numbered accordingly. Morphological terminology follows that of Lawrence (1951). Measurements in descriptions give length unless otherwise indicated. Habitat and distribution are summarized for all the taxa treated here, but phenology is only summarized for taxa newly described because only those are comprehensively detailed. Conservation assessments here follow IUCN (2001) terminology; the new taxa described here are all found in areas with active Red Listing projects, so detailed provisional conservation assessments are not presented here but left for these better-informed teams working in a larger context. In the citations of specimens, numbers enclosed in brackets are barcode numbers rather than permanent accession numbers. The names *Psychotria* and *Palicourea* are nomenclaturally distinct but similar and commonly confused, therefore, the non-standard abbreviations *Psy.* and *Pal.*, respectively, are used in the text here for clarification. Specimens cited have been seen unless otherwise indicated.

Taxonomy

Palicourea sect. **Didymocarpae** C. M. Taylor, sect. nov. TYPE: *Palicourea acuminata* (Benth.) Borhidi.

Haec sectio ab aliis sectionibus *Palicoureae* Aubl. praecipue fructu didymo atque pyrenis subsphaericis abaxiliter laevibus parietibus tenuibus, etiam stipularum vagina truncata ac quoque latere in lobos duos triangulares desinente atque corolla ad basem inflata distinguitur.

Shrubs and small trees, glabrous or infrequently hirtellous (*Palicourea candelabrum*); stems subquadrangular to rounded or flattened, internodes smooth. Leaves opposite; blades elliptic, ovate, obovate, lanceolate, or elliptic-oblong, often with well-developed acuminate tips, usually thin-textured, matte to shiny on one or both surfaces, margins usually entire (i.e., not ciliate); secondary veins developed, with intersecondary veins none to several and shortly developed (e.g., *Pal. candelabrum*), with venation mostly plane adaxially, apparently without domatia or sometimes with pilosulous domatia; petioles short to developed; stipules persistent, united around stem though sometimes with intrapetiolar portion of sheath reduced, with 2 lobes on each interpetiolar side, lobes generally triangular, entire (i.e., not ciliate), separated by a concave to truncate sinus. Inflorescences terminal and infrequently later displaced to pseudoaxillary, subcapitate to cymose or thyrsiform, branched for up to 4 orders, corymbiform, pyramidal, subglobose, or occasionally spiciform (*Pal. spicata*, *Pal. huampamiensis*), generally green, white, or yellow, usually with bracts reduced or few and scattered along axes or infrequently these well developed (*Pal. pandensis*), with flowers in subcapitate to laxly cymose groups of 3 to 11, these groups dichasial or infrequently scorpioid (*Pal. acuminata*, *Pal. boraginoides* (Dwyer) C. M. Taylor). Flowers sessile to shortly pedicellate, usually or perhaps always distylous, apparently diurnal; hypanthium cylindrical, turbinate, subglobose, or ellipsoid; calyx limb relatively short, 0.1–2 mm, truncate to 5-denticulate or 5-lobed, lobes triangular, entire or rarely ciliolate; corolla salverform to funnelform or tubular-funnelform, white, yellow, orange, pink, or violet, internally pubescent near middle and/or at stamen attachment, tube 3–13 mm, at base swollen and often also bent and gibbous or rarely straight (*Pal. diminuta*), straight or occasionally curved along its length, lobes 5, equal to or shorter than tube, triangular, abaxially smooth or more often with a thickening, rounded protuberance, or conical to linear horn to 2 mm; stamens 5, filaments usually well developed, inserted near or above middle of corolla tube, anthers narrowly elliptic-oblong to narrowly oblong, included to partially exserted in long-styled form, exserted in short-styled form; stigmas 2, linear, included and positioned near or above middle of corolla tube in short-styled form, exserted in long-styled form; disk 2-lobed, generally equal to or longer than calyx limb. Infructescences usually becoming reddish purple, with axes sometimes elongating or becoming markedly thickened; fruits didymous, generally 3–6 × 3–10 mm, spongy, blue, purple, or white; pyrenes 2, subglobose, abaxially (i.e., dorsally) smooth, adaxially (i.e., ventrally) with face plane, narrow, smooth or usually with a longitudinal groove, with external walls chartaceous to cartilaginous, with PGSs as a single longitudinal slit along the adaxial face or apparently sometimes lacking.

Palicourea sect. *Didymocarpae* includes 17 species found from central Mexico and Cuba through the Andes and the Amazon basin to Bolivia, central Brazil, and the Guianas, in wet forests from sea level to montane forests at 2700 m.

Key to Species of *Palicourea* sect. *Didymocarpae*

1. Inflorescence spiciform, with primary axis developed and flowers borne in sessile or subsessile glomerules directly from it, or with secondary axes 1–8 mm long and significantly shorter than the primary axis.
   2. Stipule lobes 1.5–5 mm long; flowers and fruits sessile to pedicellate with at least some flowers and fruits on pedicels 0.5–3 mm long; corolla tube 5–6 mm long ..... 10. *P. huampamiensis* (C. M. Taylor) C. M. Taylor
   2′. Stipule lobes 1.5–2.5 mm long; flowers and fruits sessile; corolla tube 4–5 mm long ..... 16. *P. spicata* (Kuntze) C. M. Taylor
1′. Inflorescences pyramidal to corymbiform or subcapitate, with primary axis short to well developed and with secondary axes also developed, 3–30 mm long, half or more as long as primary axis.
   3. Leaves drying papery to chartaceous and rather shiny on both sides, with blades gradually narrowed to acuminate tips 1–8 mm long; plants growing at 1000–2500 m in the Guayana Highlands of Venezuela and Guyana.
      4. Inflorescences with branched portion 2–6 × 2–10 cm, with 2 to 3 pairs of secondary axes; corolla tube 7–9 mm long ..... 5. *P. ceratantha* (Standl.) C. M. Taylor
      4′. Inflorescences with branched portion 1–2 × 1–2 cm, with 1 pair of secondary axes; corolla tube 8–12 mm long ..... 11. *P. jauaensis* (Steyerm.) C. M. Taylor

3′. Leaves drying papery and matte to shiny or chartaceous and matte, with blades weakly to markedly narrowed to acuminate tips 12–35 mm long; plants growing at 0–2700 m, Mexico and Cuba to northeastern South America, south-central Brazil, and Bolivia.
5. Flowers regularly subtended by well-developed bracts 2–5 mm long, with largest bracts up to 12 mm long ..... 13. *P. pandensis* (Standl.) C. M. Taylor
5′. Flowers not regularly subtended by bracts or these reduced, with most bracts up to 1.5 mm long and largest bracts up to 5 mm long.
6. Plants hirtellous to pilosulous on vegetative structures, in particular young stems, stipules, and leaf abaxial surfaces ..... 4. *P. candelabrum* (Standl.) C. M. Taylor
6′. Plants glabrous to puberulous on vegetative structures.
7. Corolla tubes 9.5–13 mm long.
8. Stipule lobes 2–10 mm long; calyx limb 1–1.3 mm long; corolla lobes abaxially with projections or horns 0.3–1 mm long ..... 8. *P. cuspidulata* (K. Krause) C. M. Taylor
8′. Stipule lobes 1–3 mm long; calyx limb 0.2–0.4 mm long; corolla lobes abaxially smooth or with a thickening to 0.2 mm high ..... 14. *P. rhodothamna* (Standl.) C. M. Taylor
7′. Corolla tubes 2.5–9 mm long.
9. Corolla lobes abaxially with well-developed projections or horns 0.3–1.5 mm long.
10. Inflorescences with scattered bracts 0.8–3 mm long; plants drying reddish purple, growing at 800–2000 m ..... 7. *P. cuspidata* (Bredem. ex Schult.) C. M. Taylor
10′. Inflorescences with bracts lacking or few and reduced, to 0.3 mm long; plants drying green to yellowish brown, growing at 0–800 m ..... 17. *P. subcuspidata* (Muell. Arg.) C. M. Taylor
9′. Corolla lobes abaxially smooth or with a thickening to 0.2 mm high.
11. Inflorescences with higher-order axes scorpioid.
12. Corolla tubes 3.5–6 mm long; plants growing in Brazil ..... 1. *P. acuminata* (Benth.) Borhidi p.p.
12′. Corolla tubes 6–7 mm long; plants growing in Panama ..... 3. *P. boraginoides* (Dwyer) C. M. Taylor
11′. Inflorescences with higher-order axes dichasial.
13. Corolla tubes 2.5–3.2 mm long, straight at base and in tube ..... 9. *P. diminuta* C. M. Taylor
13′. Corolla tubes 3–7 mm long, swollen and bent at least weakly at base, straight to curved in tube.
14. Leaves drying stiffly papery to chartaceous; plants growing on sandstone substrates in lower Magdalena River basin in northern Colombia ..... 15. *P. sanluisensis* C. M. Taylor
14′. Leaves drying thinly papery; plants growing on various substrates in Mexico, Central America, and South America to Bolivia and Brazil.
15. Stipule lobes 0.5–1.2 mm long; plants drying deep reddish purple; growing at 1000–2700 m ..... 2. *P. andina* C. M. Taylor
15′. Stipule lobes 1–5 mm long with at least some stipule lobes on a plant 1.5 mm long or longer; plants drying green, yellowish brown, or green flushed with reddish purple; growing at 0–1752 m.
16. Plants robust, with leaf blades 14–33 × 6–18 cm and inflorescences with branched portion 3–9 × 4–8 cm; plants found in central Peru ..... 6. *P. compta* (Standl.) C. M. Taylor
16′. Plants less robust, with leaf blades 5–26 × 2–11 cm and inflorescences with branched portion 1.5–4.5 × 2–4.5 cm; plants found from Mexico through Bolivia and Brazil.
17. Stipule sheaths 0.5–2 mm long; calyx limb 0.3–0.5 mm long; corolla lobes 2–3 mm long; plants growing at 0–1500 m, Mexico to Brazil ... 1. *P. acuminata* (Benth.) Borhidi p.p.
17′. Stipule sheaths 0.3–1 mm long; calyx limb 0.1–0.3 mm long; corolla lobes 1.5–2 mm long; plants growing at 950–1732 m in northern Bolivia ..... 12. *P. madidiensis* C. M. Taylor

1. Palicourea acuminata (Benth.) Borhidi, Acta Bot. Hung. 53(3–4): 243. 2011. *Psychotria acuminata* Benth., Bot. Voy. Sulphur, 107. 1845. *Uragoga acuminata* (Benth.) Kuntze, Revis. Gen. Pl. 1: 299. 1891. TYPE: Colombia. Cauca: Isla Gorgona & Colombian coast, 1842, *R. B. Hinds & A. Sinclair 373* (holotype, BM not seen; isotype, K[000432855] digital image).

Psychotria urophylla Schltdl., Linnaea 28: 522. 1856. *Uragoga urophylla* (Schltdl.) Kuntze, Revis. Gen. Pl. 2: 963. 1891. TYPE: Brazil. Amazonas, s.d., *E. Poeppig 1578* (holotype, HAL not seen; isotype, B†, B as F neg. # 651 at MO).

Habitat and distribution. *Palicourea acuminata* is known from wet forests at 0–1500 m in Mexico, Central America, Cuba, and Colombia through

Venezuela to the Guianas and southward to western Brazil and central Peru.

Discussion. Descriptions of this species as it is circumscribed here were presented by Steyermark (1974: 1315–1316), Taylor (2001b: 2256), and Lorence et al. (2012: 218). *Palicourea acuminata* is circumscribed here generally following Steyermark (1972, 1974), who differed from previous authors (e.g., Standley, 1930, 1931, 1936; Bremekamp, 1934). However, *Pal. acuminata* is circumscribed a little more narrowly here, with some plants from northeastern South America separated in *Pal. diminuta* and some plants from mountains in Panama and South America separated in *Pal. andina*. Also, *Pal. acuminata* is similar in aspect and many details to *Pal. subcuspidata*, and these have been extensively confused. *Palicourea acuminata* can be recognized by its inflorescences that are rounded to broadly pyramidal in outline, corolla lobes that are smooth abaxially, and leaves with prolonged acuminate tips 1–2.5 cm long versus inflorescences broadly rounded to nearly flat-topped in outline, corolla lobes with hornlike appendages abaxially, and leaves generally acuminate but with the tips not markedly prolonged in *Pal. subcuspidata*; these two species are difficult to distinguish in fruit. *Palicourea diminuta* is similar to both of these two species but can be recognized by its leaves that are generally similar to those of *Pal. subcuspidata* C. M. Taylor, generally quite flat-topped inflorescences smaller than those of both of these other two species, and corollas that are shorter than in these other two species, generally straight in the tube, and with the lobes smooth abaxially. The separation of *Pal. acuminata* and *Pal. andina* is outlined under this last species. Also similar is *Pal. compta* of Peru; see its discussion for more details.

Palicourea acuminata as circumscribed here is found widely and shows some morphological variation across this range. In particular, plants from the northern part of its range in Mexico, Cuba, Central America, Pacific coastal Colombia and Ecuador, and the Caribbean coast of Colombia and Venezuela are characterized by their rounded-corymbiform inflorescences, with the basalmost secondary axes generally longer than the primary axis, and the calyx limb truncate to sinuate or very shallowly lobed (e.g., *H. H. Smith 2083*, Magdalena, Colombia, MO; *E. Forero & R. Jaramillo 4479*, Chocó, Colombia, MO). These plants match the type of *Psychotria acuminata* in these features. Plants from the southern part of the range of this species, in Amazonian southern Colombia, southern Venezuela, and southern Guyana to Peru, are not separable morphologically but generally have more pyramidal inflorescences, with the primary axis equal to or longer than the secondary axes, and calyx limbs often lobed for half to nearly all their length (e.g., *D. Clarke 2777*, Guyana, MO; *R. Foster 9286*, Peru, MO). Plants of this second form match the type of *Psy. urophylla*. Plants from intermediate areas, in particular central Colombia to central Venezuela, have rounded-corymbiform inflorescences and shallowly to deeply lobed calyx limbs, i.e., a mixture of the characteristics of the two forms (e.g., *G. Aymard et al. 4558*, Miranda, Venezuela, MO; *J. de Bruijn 947*, Barinas, Venezuela, MO; *L. Quiñones 1584*, Meta, Colombia, MO). Some plants from northeastern Brazil characteristically develop prolonged scorpioid inflorescence axes (e.g., *P. Maas et al. 6336*, Brazil, Amazonas, MO), in contrast to the generally dichasial axes in most plants of *Pal. acuminata*. These plants do not differ otherwise and are here considered a local morphological variant. A similar inflorescence arrangement is found in *Pal. boraginoides*, which is found in central Panama. *Palicourea boraginoides* can be recognized by its corolla tubes 6–7 mm long and larger fruits, ca. 5 × 7 mm, versus the tubes 4–4.5 mm long and fruits 3–5 × 4–6 mm in these Brazilian plants.

The attribution of the type locality of *Psychotria urophylla* to Amazonas State in Brazil follows Andersson (1992).

2. Palicourea andina C. M. Taylor, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: above Valladolid on rd. Yangana, 2300 m, 1 Feb. 1985, *G. Harling & L. Andersson 21405* (holotype: MO-4278928). Figure 1A–C.

Haec species a *Palicourea cuspidata* (Bredem. ex Schult.) C. M. Taylor limbo calycino breviore atque lobis corollinis ecornutis, a *Palicourea acuminata* (Benth.) Borhidi tubo corollino longiore distinguitur; etiam aliter a hac silvas premontanas montanasque habitat.

Shrubs or small trees flowering at 1 m tall, to 4 m tall; stems glabrous. Leaves with blades narrowly elliptic to elliptic, lanceolate, elliptic-oblong, or elliptic-lanceolate, 7–16.5(–19) × 1.5–5.5(–11) cm, at base acute to cuneate or occasionally obtuse (rounded), at apex acuminate with slender, often falcate tips 12–30 mm, drying papyraceous, adaxially glabrous and often shiny, abaxially glabrous; secondary veins 8 to 13 pairs, looping to interconnect, without domatia, adaxially costa prominulous, secondary veins thickened to prominulous, and remaining venation plane to thickened, abaxially costa prominent, secondary veins prominulous, and remaining venation plane to thickened; margins plane, entire; petioles 0.4–1.8 cm, glabrous; stipules persistent, glabrous, united around stem, sheath

truncate, 0.3–1 mm, lobes 2 per side, deltoid to narrowly triangular, 0.5–1.2 mm, acute. Inflorescences terminal, paniculate, glabrous, apparently green; peduncle 1–2.6 cm; branched portion pyramidal, 1.5–5 × 2–6 cm, branched to 2 or 3 orders, secondary axes 2 to 4 pairs; bracts reduced or few, narrowly triangular, up to 0.3 mm, borne along internodes of axes; pedicels to 1.5 mm. Flowers mixed sessile, subsessile, and pedicellate in dichasial cymules of 5 to 9, distylous; hypanthium cylindrical to turbinate, 0.5–0.8 mm long, glabrous; calyx limb 0.3–0.5 mm, glabrous, dentate; corolla in bud broadly obtuse to truncate at apex, at anthesis tubular to salverform, white to pale yellow (subsp. *andina*) sometimes flushed with purple (subsp. *panamensis*), externally glabrous, internally glabrous except puberulous to hirtellous in a zone ca. 2 mm wide at middle of tube, tube 3–7 mm, usually bent and gibbous at base, curved to straight along its length, lobes triangular, 2–2.5 mm, abaxially smooth or with a rounded to warty thickening to 0.1 mm high; anthers in long-styled form ca. 2.5 mm, partially exserted or included and positioned in corolla throat, in short-styled form 2–2.2 mm, exserted; stigmas in long-styled form ca. 0.5 mm, well exserted, in short-styled form ca. 1.5 mm, included and positioned near middle of corolla tube. Infructescences similar to inflorescences except becoming wine-red to purple; fruit didymous, 3–4 × 5–6 mm, glabrous, purple or blue; pyrenes subglobose, abaxially smooth, adaxially plane except with shallow longitudinal groove, with external wall chartaceous.

Habitat, distribution, and phenology. *Palicourea andina* is known from wet montane and less often premontane forest, at 1100–2700 m but usually above 1500 m, in western Panama and the Andes from western Colombia to northern Bolivia; it has been collected in flower January through April and November through December, and in fruit in February, April through September, and November.

IUCN Red List category. *Palicourea andina* is assessed as NE.

Discussion. *Palicourea andina* is found in mountain vegetation with its main geographic range in the western Andes, and the specific epithet refers to this region. Leaf characters in parentheses correspond to a few plants from Peru (e.g., *Foster 9132*, *Smith & Pretel 1638*), which differ from the rest of the plants of this species, including other plants from the same region, in only these details. Plants of *Pal. andina* have previously been included variously in *Pal. acuminata*, *Pal. compta*, and *Pal. cuspidata*, which are all similar. However, *Pal. acuminata* can be recognized by its generally shorter corolla tubes, 3.5–5.5 mm long in the regions where both species are found, and its habitat in lowland forest vegetation at 0–1500 m. *Palicourea compta* is found at generally lower elevations in central Peru; see its discussion for more details of its recognition. *Palicourea cuspidata* is also found in mountain forests in Colombia and northern Ecuador but can be recognized by its inflorescences with regularly developed bracts 0.3–3 mm long, usually longer calyx limbs 0.3–1.8 mm long, and corolla lobes with well-developed horns 0.3–1.5 mm long on the abaxial (i.e., outer) surface. *Palicourea andina* is also similar to *Pal. madidiensis* of northern Bolivia; see under this last species for details of their separation.

Plants from the mountains of western Panama are similar to the Andean plants of *Palicourea andina* except they have smaller corollas. These plants are also geographically disjunct and here treated as a distinct subspecies.

Key to Subspecies of *Palicourea andina*

1. Stipule lobes triangular to narrowly triangular; corolla white to pale yellow, with tube 5–7 mm long; plants found in Andes in South America ..... 2a. *P. andina* subsp. *andina* C. M. Taylor

1′. Stipule lobes narrowly triangular; corolla pale yellow to white flushed with purple at base or perhaps throughout, with tube 3–4 mm long; plants found in western Panama ..... 2b. *P. andina* subsp. *panamensis* C. M. Taylor

2a. Palicourea andina subsp. **andina**. Figure 1A–C.

Stipules with lobes triangular to narrowly triangular. Corolla white to pale yellow, tube 5–7 mm long.

Habitat, distribution, and phenology. *Palicourea andina* subsp. *andina* is known from wet montane and less often premontane forest, at 1100–2700 m but usually above 1500 m, in the Andes of western Colombia to northern Bolivia; it has been collected in flower January through April and November through December, and in fruit in February, April through September, and November.

Paratypes. BOLIVIA. **La Paz:** Franz Tamaho, región Madidi, Santo Domingo, sector Lechemayu, Parcela Permanente 49, 14°46′S, 68°37′W, *A. F. Fuentes, P. Miranda, C. Miranda, L. Vaquiata & E. Segales 17035* (MO). COLOMBIA. **Antioquia:** mpio. Urrao, ver. el Bote, carr. a La Magdalena, quebrada La Magdalena, *J. Betancur, R. W. Pohl, F. J. Roldán, O. Marulanda & M. M. Escobar 224* (MO); ver. Llano Grande, al lado del Río Llano Grande, *J. Betancur, R. W. Pohl, F. J. Roldán, O. Marulanda & A. Betancurt 246* (MO); mpio. Amalfi, sector La Viborita, *A. L. Correa 12* (MO); ver. Arenasblancas, 6°55′N, 74°55′W, *R. Fonnegra G. & Grupo Palinología Sem. I/94 4750* (MO). **Caldas:** Pensilvania, ver. El Dorado,

Finca Pamirita, *L. M. Alvares M. 1296* (MO). **Cauca:** mpio. El Tambo, Parque Nac. Munchique near Las Palmas, 2°43′N, 76°58′W, *L. Andersson, F. González, C. Gustafsson, C. Persson & J. H. E. Rova 2117* (MO). **Chocó:** Alto del Buey, *A. Gentry & E. Forero 7338* (MO); Emisora La Sirena, 3 km W of La Mansa at top of Cordillera Occidental, *A. Gentry & E. Rentería A. 24240* (MO). **Putumayo:** mpio. Mocoa, correg. San Antonio, ver. Alta Campucana, camino entre finca La Mariposa y Alto La Sierra, 1°12′N, 76°38′W, *J. Betancur B., P. Galvis & Z. Marín 5411* (MO). **Valle:** rte. Cali–Buenaventura Km. 18, *F. Billiet & B. Jadin 6902* (MO); Cali–Buenaventura hwy. Km. 29, 3°28′N, 76°39′W, *T. B. Croat & J. Watt 70508* (MO); W of Buga [i.e., Bugalagrande], 6 km N intersection rd. to Darien via El Caney & rd. La Guajira, slopes of Río Calima, 4°00′N, 76°30′W, *L. McDade & B. Stein 970* (MO); mpio. Cali, correg. Felidia, Finca el Diamante de Joel Otero Arragón, *J. Tupac Otero 131* (MO); correg. La Elvira, Finca Zíngara, Km. 4 carr. entre Km. 18 en la carr. Cali–Buenaventura y Dapa, Cordillera Occidental, *P. A. Silverstone-Sopkin & J. Giraldo-Gensini 6535* (MO); mpio. Yotoco, Cordillera Occidental, Eern slopes, hwy. betw. Dapa & Loboguerrero at Parque Yotoco, 3°52′N, 76°22′W, *T. B. Croat 70690* (MO), *H. Murphy & [no initial given] Madrid 652* (MO), *S. Sarria 2Y* (MO); 3 km N of Cali–Buenaventura hwy. on rd. to Dapa, 3°32′N, 76°37′W, *T. B. Croat & J. F. Gaskin 79972* (MO); Finca La Mesita W of Villa Colombia, E slope Cordillera Occidental, 3°08′N, 76°40′W, *A. H. Gentry, A. Juncosa & W. Ladrach 40899* (MO); mpio. Yumbo, Finca La Samaria NE of Darién, near Lago Calima, 4°07′N, 76°30′W, *A. Juncosa 2159* (MO). ECUADOR. **El Oro:** Hacienda Buenaventura, 12 km W Piñas on rd. Machala, 3°48′S, 79°46′W, *M. Kessler 2592* (MO); parroq. El Placer, Reserva Ecol. Buenaventura, Cerro Las Bateas, 3°40′S, 79°46′W, *H. Vargas, W. Defas & B. Becerra 5457* (MO). **Morona-Santiago:** Plan del Milagro at cross-rd. betw. Limón & Indanza, *G. Harling & L. Andersson 24543* (MO); Limon Indanza, parroq. Santa Susana de Chiviaza, región de la Cordillera del Cóndor, al O del Río Zamora, arriba de la pobl. El Pescadero a 2 km al SE de Santa Susana, 2°58′S, 78°20′W, *C. Morales & D. Reyes 1855* (MO), *D. Reyes & C. Morales 1175* (MO). **Napo:** cantón Archidona, Reserva Ecol. Antisana, comun. Shamato, cam. Sardina-Shamato, 00°44′S, 77°48′W, *J. L. Clark, E. Narvaez & P. Mamllacta 5377* (MO); Parque Nac. Sumaco-Galeras, Cordillera Galeras, 0°50′S, 77°32′W, *S. Mortiz, S. Trogisch & J. Homeier 110* (MO); 0°51′S, 77°31′W, *H. Vargas & M. Mamallacta 4182* (MO); Faldas de Galeras, Bloque 19, línea sísmica 30, 00°53′N, 77°33′W, *E. Freire & J. Cerda 402* (MO). **Pichincha:** Reserva de ENDESA, Km. 113 Quito–Pto. Quito rd., 0°05′N, 79°02′W, *J. L. Luteyn & F. Borchsenius 13360* (MO). **Zamora-Chinchipe:** Estac. Cient. San Francisco hwy. Loja–Zamora ca. Km. 30, ca. 35 km from Loja, 3°58′S, 79°04–05′W, *P. Butz 26* (MO), *C. Dziedzioch 149* (MO), *J. Homeier 4167* (MO), *J. Homeier, P. Butz & R. Link 5011* (MO), *R. Link 34* (MO), *D. Wolff 45* (MO), *D. Wolff 131*, *180* (MO); Yantzaza, Cordillera del Cóndor, carr. Los Encuentros hacia el Cerro Machinaza, bosque El Zarza, 3°51′S, 78°32′W, *W. Quizhpe 1733* (MO). PERU. **Amazonas:** ca. 12 trail km E of La Peca in Serranía de Bagua, *A. H. Gentry, M. Dillon, J. Aronson, C. Díaz & P. Barbour 23024* (MO); prov. Chachapoyas, Chilchos, *J. D. Boeke 2096* (MO); prov. Concorcanqui, Cordillera del Cóndor, Puesto de Vigilancia Alfonso Ugarte (PV3), cabeceras del Río Caminas, tributario al O del Río Cenepa, 3°55′S, 78°26′W, *H. Beltán & R. Foster 1020* (MO); prov. Luya, distr. Camporredondo, Tullanya, *J. Campos, R. Vásquez & R. R. Gonzóles 3035* (MO), *C. Díaz & A. Peña 8702* (MO); Jaipe, Fundo "El Paraiso," *C. Díaz & J. Campos 3573* (MO); Ocallí, Ouispe, propeidad de San Estebau Fernández, *C. Díaz, J. Campos & L. Campos 4367* (MO); Campore dendo, montañas de "Jaype," *C. Díaz & L. Campos 4480* (MO). **Cajamarca:** prov. San Ignacio, distr. Coipa, La Lima, 5°25′S, 78°49′W, *J. Campos & M. Lopez 2566* (MO); distr. Huarango, El Triunfo-Convento, 5°13′S, 78°40′W, *J. Campos & E. Rodríguez 2832* (MO); Nuevo Mundo, quebrada Santa Rosa a 2 horas de Pisaguas, 5°10′W, 68°32′W, *J. Campos & S. Núñez 4597* (MO); poblado Selva Andina, 5°04′S, 78°43′W, *J. Perea, E. Becerra, A. Peña & J. Díaz 3733* (MO); Nuevo Mundo-Caserío Pisaguas, 5°15′S, 78°38′S, *D. Pino, J. Campos, et al. [sic on label] 178* (MO), *D. Pino, J. Campos, et al. [sic on label] 204A* (MO); distr. San José de Lourdes, camino al Cerro Picorana, 5°02′S, 78°54′W, *J. Campos, L. Campos & L. Zurita 5499* (MO); base del Cerro Picorana, 4°50′S, 78°54′W, *C. Díaz, J. Opisso, S. Flores & F. Camargo 10277*, *10772* (MO); base del Cerro El Parco, 5°05′S, 78°54′W, *R. Vásquez, J. Campos, G. Calatayud, M. Huamán & B. Cordova 26684* (MO). **Junin:** prov. Satipo, Gran Pajonal, E of Cequitavo on trail Dotampaz, 10°45′S, 74°23′W, 1200 m, *D. N. Smith 6743* (MO). **Pasco:** prov. Oxapamapa, rd. Oxapampa–Paucartambo 20 km from Oxapampa, 10°35′S, 75°28′W, *D. Smith & A. Pretel 1638* (MO); distr. Chontabamba, low pass betw. Chontabamba & Suissa W of Oxapampa, 10°36′S, 75°34′W, *R. B. Foster & D. N. Smith 7570* (MO); distr. Villa Rica, rd. in construction Oxapampa–Villa Rica, Km. 7, 10°37′S, 75°20′W, *R. Foster, M. Chanco, D. N. Smith & J. Albán 7791* (MO), *R. B. Foster 9132* (MO); sector Bocáz, camino a Purus, 10°38′S, 75°12′W, *J. Perea & J. L. Mateo 4341* (MO). **San Martín:** prov. Rioja, Pedro Ruíz–Moyobamba rd., Km. 390, Venceremos, 5°50′S, 77°45′W, *D. N. Smith 4476* (MO). **Ucayali:** prov. Coronel Portillo, distr. Iparia, cuenca del Río Iparia, Reserva Comunal El Sira, 9°28′S, 74°34′W, *J. G. Graham 5002*, *5832* (MO).

2b. Palicourea andina subsp. **panamensis** C. M. Taylor, var. nov. TYPE: Panama. Chiriquí: vic. Fortuna Dam, 8°45′N, 82°15′W, 1100 m, 8 Feb. 1987, *G. McPherson 10427* (holotype, MO-3616876).

Haec subspecies a *Palicourea andina* C. M. Taylor subsp. *andina* corolla ad basem (fortasse omnino) purpureo-tincta tubo 3–4 mm longo distinguitur.

Stipules with lobes narrowly triangular. Corolla pale yellow to white flushed with purple at base or perhaps throughout, tube 3–4 mm long.

Habitat, distribution, and phenology. *Palicourea andina* subsp. *panamensis* is known from wet premontane forest at 1100–1150 m in western Panama; it has been collected in flower in February and May and has not yet been collected in fruit.

IUCN Red List category. *Palicourea andina* subsp. *panamensis* is assessed as NE.

Discussion. Only two flowering collections have been seen, which document both short-styled (the type) and long-styled flowers.

Paratype. PANAMA. **Bocas del Toro/Chiriquí border:** along Continental Divide on Carr. del Oleoducto ca. 1 km N of Quebrada Arena, IRHE Fortuna Dam Project, 8°46′N, 82°12′W, *S. Knapp 5080* (MO).

3. Palicourea boraginoides (Dwyer) C. M. Taylor, comb. nov. Basionym: *Psychotria boraginoides* (Dwyer) C. M. Taylor, Novon 21(1): 144. 2011. *Psychotria acuminata* Benth. subsp. *boraginoides* Dwyer, Ann. Missouri Bot. Gard. 67(2): 344. 1980. TYPE: Panama. Panamá: 12 mi. above Panamerican Hwy., 200–500 m, 26–27 Mar. 1973, *R. Liesner 1187* (holotype, MO-2164366; isotype, MO-239472).

Habitat and distribution. Palicourea boraginoides is known from wet forests at 50–800 m in central Panama.

Discussion. A description of this species was presented by Lorence et al. (2012: 220), as *Psychotria boraginoides* Dwyer. These plants have been included within the circumscription *Psy. acuminata* but appear to be distinct (Taylor et al., 2011); see the discussion of *Palicourea acuminata* for details of their separation.

4. Palicourea candelabrum (Standl.) C. M. Taylor, comb. nov. Basionym: *Psychotria candelabrum* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(3): 207. 1930. TYPE: Peru. Loreto: La Victoria on Amazon River, 23 Aug. 1929, *Llewelyn Williams 2702* (holotype, F-604492 digital image).

Shrubs flowering at 1.8 m tall, to 3 m tall; stems hirtellous or pilosulous becoming glabrescent. Leaves with blades elliptic to obovate, 9–22.5 × 2.5–11.5 cm, at base acute to obtuse, at apex acuminate with slender sometimes falcate tips 6–18 mm, drying papyraceous, adaxially glabrous except puberulous on costa and sometimes also secondary veins, abaxially pilosulous to glabrescent except consistently puberulous to pilosulous on costa and secondary veins; secondary veins 10 to 13 pairs, looping broadly to interconnect near margins, adaxially costa and secondary veins prominent and remaining venation plane to prominulous; margins puberulous to entire; petioles 0.8–1.2 cm, puberulous to pilosulous; stipules persistent, puberulous to pilosulous, united around stem, sheath truncate, 1–2 mm, lobes 2 per side, triangular to ovate, 2–5 mm, acute. Inflorescences terminal, cymose, hirtellous to pilosulous, green to yellow; peduncle 1.5–2.5 cm, usually with articulation with stipuliform bracts in basal half; branched portion corymbiform, 1–3 × 3–5 cm, branched to 2 or 3 orders, secondary axes 3 to 5 pairs and congested to separated along primary axis; bracts several and scattered, triangular to lanceolate, 0.3–2 mm. Flowers sessile and subsessile in dichasial cymes of 9 to 11, biology unknown; hypanthium subglobose, ca. 0.3 mm, densely pilosulous; calyx limb ca. 0.3 mm, pilosulous, truncate to dentate; corolla in bud truncate at apex, at anthesis funnelform, yellow, externally puberulous, internally glabrous except with pilosulous ring near middle of tube, tube ca. 5 mm, bent and swollen at base, curved along its length, lobes triangular, ca. 2.5 mm, abaxially with linear projections 0.3–0.4 mm; anthers ca. 1.1 mm, exserted; stigmas ca. 1 mm, partially exserted and positioned in corolla throat. Infructescences similar to inflorescences except becoming dark red; fruit didymous, ca. 6 × 4 mm (ca. 8 × 10 mm in life, *Schunke 10928*), glabrescent, pale violet; pyrenes subglobose, abaxially smooth, adaxially plane with shallow longitudinal groove, with external walls stiffly chartaceous.

Habitat, distribution, and phenology. Palicourea candelabrum is known from wet forests at 100–300 m elevation in the western Amazon basin, from southern Colombia to northeastern Peru and western Brazil; it has been collected in flower in June and with mature fruits in March.

Discussion. Palicourea candelabrum was described based on one collection with young fruit, and no better known for a long time. Recent collections have now documented mature fruits and flowers, so a full description is presented here. This species has been diagnosed in part by its hirtellous pubescence, and all the specimens seen have this feature, but it is possible that its pubescence is variable and glabrous plants may be found.

Additional specimens studied. BRAZIL. **Acre:** Tarauacá, complexo de florestas estaduais Mogno, Gregório y Liberdade, margem da BR-364, 7°59′S, 71°23′W, *M. Silveira, F. Obermuller, C. S. Pessoa, E. C. de Oliveira & I. Rivera 3949* (NY). COLOMBIA. **Amazonas:** Leticia, *S. McDaniel 11436* (MO). PERU. **Loreto:** prov. Coronel Portillo, distr. Galleria, Bosque Nac. Alexander von Humboldt, entre San Alejandro y Pucullpa Km. 100, *J. Schunke V. 10928* (MO).

5. Palicourea ceratantha (Standl.) C. M. Taylor, comb. nov. Basionym: *Psychotria ceratantha*

Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 7(4): 439. 1931. TYPE: Venezuela. Amazonas: Mount Duida, ca. 15 m below summit Peak No. 7, 2115 m, Aug. 1928–Apr. 1929, *H. H. Tate 669* (holotype, NY-132636 digital image, NY-132636 as F. neg. #50370 at MO; isotype, NY-132627 digital image).

Psychotria arenaria Standl. & Steyerm., Fieldiana, Bot. 28: 594, fig. 132. 1953. TYPE: Venezuela. Bolívar: Ptaritepuí, base of S-facing sandstone bluffs, 2140 m, 6 Nov. 1944, *J. A. Steyermark 59869* (holotype, F-1181733 digital image; isotype, F-1181732 digital image).

Psychotria yutajensis Steyerm., Ann. Missouri Bot. Gard. 75: 348. 1988. TYPE: Venezuela. Amazonas: Dept. Atures, summit E slope of unnamed peak, 8 km NW Yutaje, 4 km W Rio Coro Coro, W Serrania Yutaje, 1500–1760 m, 4 Mar. 1987, *R. Liesner & B. Holst 21649* (holotype, MO-3482981; isotype, VEN not seen).

Habitat and distribution. *Palicourea ceratantha* is known from wet premontane and montane forests at 1000–2400 m, generally on sandstone substrates, in the Guayana Highlands of southeastern Venezuela and adjacent western Guyana.

Discussion. Descriptions and an illustration of this species were presented by Taylor et al. (2004: 732) and Steyermark (1974: 1317–1320, fig. 204). This species was circumscribed by Taylor et al. more broadly than previously, as "a complex of forms found on different mountains and not fully separable morphologically" with the names *Psychotria arenaria* and *Psy. yutajensis* synonymized there. *Palicourea ceratantha* is similar to and probably closely related to *Pal. jauaensis*, which is found on similar substrates in the same region.

6. Palicourea compta (Standl.) C. M. Taylor, comb. nov. Basionym: *Psychotria compta* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(3): 202. 1930. TYPE: Peru. Loreto: Yurimaguas, lower Rio Huallaga, 135 m, 22 Aug.–9 Sep. 1929, *E. P. Killip & A. C. Smith 29098* (holotype, F-607750 digital image).

Shrubs and small trees flowering at 1 m tall, to 4 m tall; stems glabrous. Leaves with blades elliptic to broadly elliptic, obovate, or ovate, 14–33 × 6–18 cm, at base cuneate to obtuse, at apex acuminate with slender tips 10–40 mm, drying papyraceous, on both surfaces glabrous and shiny; secondary veins 12 to 15 pairs, looping to interconnect, with pilosulous domatia, adaxially and abaxially costa and secondary veins prominent and tertiary venation and some quaternary venation prominulous; margins plane, entire; petioles 1–2.3 cm, glabrous; stipules persistent, glabrous, united around stem, sheath truncate, 1–2 mm, lobes 2 per side, ligulate to broadly triangular, 2–3.5 mm, obtuse to rounded. Inflorescences terminal, paniculate, puberulous, apparently green; peduncle 1–3 cm; branched portion pyramidal to broadly pyramidal, 3–9 × 4–8 cm, branched to 2 to 4 orders, secondary axes 3 to 6 pairs; bracts reduced; pedicels to 1.5 mm. Flowers mixed sessile, subsessile, and shortly pedicellate in dichasial cymules of 7 to 13, distylous; hypanthium cylindrical, ca. 0.5–0.8 mm, glabrous; calyx limb 0.1–0.3 mm, glabrous, truncate to shallowly lobed, entire to ciliolate; corolla in bud broadly obtuse to truncate at apex, at anthesis funnelform, white to cream, externally puberulous, internally hirtellous in upper half of tube, tube 4–5 mm, at base weakly swollen, bent, and sometimes weakly gibbous, curved along its length, lobes triangular, 2–3 mm, abaxially with rounded thickenings to ca. 0.1 mm; anthers ca. 1.5 mm, in long-styled form included and positioned at or just above middle of corolla tube, in short-styled form exserted; stigmas in long-styled form 0.8–1 mm, exserted, in short-styled form not seen. Infructescences similar to inflorescences except becoming purple-red; fruit didymous, 4–5 × 5–6 mm (to ca. 7 × 10 mm in life), glabrous, white or blue; pyrenes subglobose, abaxially smooth, adaxially plane with shallow longitudinal groove, with external walls cartilaginous to chartaceous.

Habitat, distribution, and phenology. *Palicourea compta* is known from wet forests at 135–1050 m on the eastern slopes of the Andes of central Peru, often on sandy or sandstone-derived substrates; it has been collected in flower July through October, and in fruit February through August and in November and December.

Discussion. *Palicourea compta* can be recognized within *Palicourea* sect. *Didymocarpae* by its relatively large leaves, relatively broad stipule lobes, and rather lax paniculiform inflorescences. A detailed description is presented here because the only existing description (Standley, 1936: 188) was based on limited material and not adequate to clarify its identity, and the circumscription of *Pal. compta* is narrowed here. *Psychotria compta* originally included plants with corolla tubes 5–8 mm long found at 135–1900 m, but here only plants with corolla tubes 4–5 mm long from lower elevations are included; plants with longer corolla tubes from mountain forest vegetation are here included in *Pal. andina*.

Palicourea acuminata is similar to *Pal. compta* but can be recognized by its inflorescences with the primary axis generally about equal to or shorter than

the peduncle and the basalmost secondary axes clustered to subverticillate, triangular to narrowly triangular stipule lobes, and leaves with the tertiary venation plane or less prominent than the secondary veins on the upper surface; versus in *Pal. compta* inflorescences with the primary axis longer than the peduncle and the secondary axes distributed in pairs along it, ligulate to broadly triangular stipule lobes, and leaves with the secondary and tertiary venation similarly developed and regularly raised on the upper surface. The separation of these species may deserve further study.

7. Palicourea cuspidata (Bredem. ex Schult.) C. M. Taylor, comb. nov. Basionym: *Psychotria cuspidata* Bredem. ex Schult., Syst. Veg. 5: 192. 1819. *Uragoga cuspidata* (Bredem. ex Schult.) Kuntze, Revis. Gen. Pl. 2: 955. 1891. TYPE: Venezuela. [Distrito Federal:] Caracas, s.d., *F. Bredemeyer s.n.* (holotype, B-WILLD-4109 digital image and microfiche, B-WILLD-4109 as F neg. #534 at MO).

Habitat and distribution. *Palicourea cuspidata* is known from premontane and montane forests at 800–2000 m in the Cordillera de la Costa in northern Venezuela, the Sierra de Santa Marta in northern Colombia, and the Andes from Venezuela through western Colombia to northern Ecuador.

Discussion. *Palicourea cuspidata* is characterized by its thin-textured leaves with well-developed tips, pyramidal inflorescences, corollas with funnelform tubes and well-developed abaxial horns on the lobes, reddish purple drying color, and range at higher elevations. This species is circumscribed here similarly to Steyermark (1974: 1312–1315, fig. 203). As noted by him, *Psychotria cuspidata* was previously circumscribed more broadly (e.g., Standley, 1930, 1936; Bremekamp, 1934), to include also plants here separated in *Pal. acuminata*, *Pal. andina*, and *Pal. subcuspidata*. *Palicourea acuminata* and *Pal. andina* can be separated from *Pal. cuspidata* by their corollas that lack abaxial horns or appendages on the lobes; *Pal. subcuspidata* shares corolla horns with *Pal. cuspidata* but can be recognized by its flat-topped to broadly rounded inflorescences, green to yellowish brown drying color, and habitat at lower elevations, 0–800 m.

Steyermark (1974) reported this species (as *Psychotria cuspidata*) to be restricted to the Cordillera de la Costa of Venezuela and to be characterized by its calyx limbs 1.5–1.8 mm long and its corolla tubes 5–6 mm long. However, he cited there a specimen from Lara State, in the northeastern Andes west of the Yaracuy depression that separates these mountains from the Cordillera de la Costa. Standley (1930) reported this species (as *Psy. cuspidata*) from Colombia with several of his specimens representing *Palicourea cuspidata* as circumscribed here. Newer collections now document *Pal. cuspidata* more widely in the Andes of western Venezuela and eastern Colombia along with more variation in calyx limb length here, to as short as 1 mm long. Various collections also document very similar plants from the western Andes, in the Cordilleras Central and Occidental of Colombia and the main Andes south of there. These plants have calyx limbs 0.3–1 mm long and corolla tubes 8–9 mm long versus 5–6 mm long in the eastern plants. These western plants have leaves and inflorescences that are more robust on average than those in the Venezuelan plants, though the overall size ranges found in the two regions overlap. The western plants are otherwise inseparable from the eastern plants of *Pal. cuspidata* and are here included in this species. Because these two groups of plants are morphologically partially distinct and apparently geographically separated, they are here treated in two subspecies. Few specimens with mature corollas have been collected for the western plants so a continuous geographic gradient in corolla size cannot be ruled out.

KEY TO SUBSPECIES OF *PALICOUREA CUSPIDATA*

1. Calyx limb 1–1.8 mm long; corolla tube 5–6 mm long; plants of Venezuela and the Sierra de Santa Marta and Cordillera Oriental of Colombia ..... 7a. *P. cuspidata* subsp. *cuspidata* (Bredem. ex Schult.) C. M. Taylor
1′. Calyx limb 0.5–1 mm long; corolla tube 5–9 mm long; plants of the Cordilleras Occidental and Central of Colombia to the Andes of northern Ecuador ..... 7b. *P. cuspidata* subsp. *occidentalis* C. M. Taylor

7a. Palicourea cuspidata subsp. **cuspidata.**

Habitat and distribution. This subspecies is known from premontane and montane forests at 800–2000 m in the Cordillera de la Costa of northern Venezuela, the Sierra de Santa Marta of northern Colombia, and the Andes of western Venezuela through the Cordillera Oriental of Colombia.

7b. Palicourea cuspidata subsp. **occidentalis** C. M. Taylor, subsp. nov. TYPE: Colombia. Valle del Cauca: mpio. Yotoco, Reserva Nat. SW de Buga, 1500 m, 17 Feb. 1990, *W. Devia 3013* (holotype, TULV; isotypes, MO-4632256, MO-5064491).

Haec subspecies a *Palicourea cuspidata* (Bredem. ex Schult.) C. M. Taylor subsp. *cuspidata* limbo calycino

breviore distinguitur; etiam distributionem geographicam dissimilem exhibet.

Shrubs and small trees flowering at 1 m tall, to 4 m tall; stems glabrous. Leaves with blades elliptic to broadly elliptic, ovate, or elliptic-oblong, 10–27 × 3–14 cm, at base obtuse to subtruncate, at apex acuminate with slender often falcate tips 10–25 mm, drying papyraceous, adaxially glabrous and often shiny, abaxially glabrous to puberulous and often shiny; secondary veins 12 to 17 pairs, looping to interconnect usually along entire length of blade, without domatia, adaxially costa and secondary veins prominulous and remaining venation plane to thickened, abaxially costa prominent, secondary veins prominulous, and remaining venation plane or infrequently thickened; margins plane, entire; petioles 1–4.5 cm, glabrous; stipules persistent, glabrous or sometimes puberulous on lobes, united around stem, sheath truncate, 0.5–2 mm, lobes 2 per side, deltoid to narrowly triangular, 1–2.5 mm, acute. Inflorescences terminal, paniculate, puberulous, apparently green sometimes flushed with purple; peduncle 1–6 cm; branched portion pyramidal to broadly pyramidal, 2.5–9 × 4–14 cm, branched to 2 or 3 orders, secondary axes 3 to 6 pairs; bracts narrowly elliptic to linear or ligulate, acute, ciliolate, on secondary axes borne along internodes, 1.5–3 mm, on pedicels 0.8–1.5 mm; pedicels 0–4.5 mm. Flowers sessile and pedicellate in dichasial cymules of 5 to 9, biology unknown; hypanthium cylindrical, 0.8–1 mm, puberulous; calyx limb 0.3–1 mm, puberulous, dentate, ciliolate; corolla in bud broadly obtuse to truncate at apex, at anthesis slenderly funnelform, cream, white, pink, or violet (apparently at least in some cases due to pigmented trichomes, e.g., *Sarria 4Y*), externally puberulous, internally glabrous except hirtellous in a ring ca. 2 mm wide at middle of tube, tube 8–9 mm, often bent and gibbous at base, curved to straight along its length, lobes triangular, ca. 3 mm, abaxially with rounded to linear projection 0.3–0.5 mm; anthers ca. 2 mm, exserted; stigmas 1.5–2 mm, included to partially exserted, positioned at or just below corolla throat. Infructescences similar to inflorescences except becoming purple; fruits didymous, 3–4 × 6 mm, glabrous, blue; pyrenes subglobose, abaxially smooth, adaxially plane except with low central ridge and shallow longitudinal groove, with external wall papyraceous.

Habitat, distribution, and phenology. *Palicourea cuspidata* subsp. *occidentalis* is known from wet premontane and montane forests at 1000–2600 m in the Cordilleras Occidental and Central of Colombia through the Andes of northern Ecuador; it has been collected in flower February, April, July, and September, and in fruit in February, March, and July through September.

IUCN Red List category. *Palicourea cuspidata* subsp. *occidentalis* is assessed as NE.

Paratypes. COLOMBIA. **Antioquia:** Parque Nac. Nat. Las Orquídeas, sector Calles, margén derecha del río Calles, 6°32′N, 76°19′W, *A. Cogollo, J. G. Ramírez & O. Alvarez 2555* (MO); mpio. Carmen del Viboral, ver. La Milagros, vi El canada, Finca la Soledad, 6°05′N, 75°25′W, *J. L. Luteyn & R. Callejas 11790* (MO). **Caquetá:** mpio. de Florencia, ver. Las Brisas, carr. Florencia-Suaza, Km. 28, 1°36′N, 75°37′W, *J. G. Ramírez, J. Gil, G. Trujillo & Y. Cendalez 4947* (MO). **Nariño:** trayecto Pialapi–La Planada, 1°10′N, 77°58′W, *O. de Benavides 10127* (MO); valley of Río Guiza, rd. El Espino–Tumaco, ca. 4 km W Ricaurte, 1°15′N, 78°05′W, *B. Hammel 17169* (MO). **Risaralda:** mpio. de Mistrató, entre los corregs. Geguadas y Puerto de Oro, *J. L. Fernández A., J. Betancur, O. Rangel, I. Rentería & J. Guzmán 9576* (MO), *9706* (MO), *9710* (MO), *9807* (COL, MO). **Valle del Cauca:** mpio. Yotoco, Cordillera Occidental, Eern slopes, Parque Yotoco along hwy. betw. Dapa & Loboguerrero, 3°52′N, 76°22–33′W, *I. Cabrera 3917* (MO), *T. B. Croat 70703, 70717* (MO), *A. Gentry, M. Monsalve, A. Meerow, D. Wolfe & T. Teefs 48073* (MO), *H. Murphy & [no initial] Madrid 662* (MO), *S. Sarria 4Y* (MO), *P. A. Silverstone-Sopkin & N. Paz 7489, 7552* (MO); Cordillera Occidental, vert. occ., hoya del río Digua, lado izquierdo del río San Juan en la región de Queremal, *J. Cuatrecasas 23736* (F); Alto Yunda, Río Anchicaya, *S. Hilty JY-26* (MO). ECUADOR. **Carchi:** comun. Maldonado, *P. Delprete & A. Verduga 6401* (MO); cantón Tulcán, parroq. El Chical, vicin. Peñas Blancas, 6.6 km N El Chical on trail to Tobar Donoso, 00°58′N, 78°11′W, *T. B. Croat 94865* (MO); Reserva Cerro Oscuro, 3 km S of El Chical, 00°55′N, 78°12′W, *T. B. Croat, G. Ferry, D. Scherberich, C. L. Henriquez R. & E. Levy 104476* (MO).

8. Palicourea cuspidulata (K. Krause) C. M. Taylor, comb. nov. Basionym: *Cephaelis cuspidulata* K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 8: 102. 1922. *Psychotria cuspidulata* (K. Krause) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(3): 201. 1930. TYPE: Peru. Loreto: Cerro de Escalor, 1200 m, Nov. 1902, *E. Ule 6551* (holotype, B†, B as F neg. #718 at MO; lectotype, designated here, F-41047 digital image; isolectotype, F-68649 digital image).

Habitat and distribution. *Palicourea cuspidulata* is known from wet lowland and premontane forests at 180–1170 m in the western Amazon basin from central Ecuador to northeastern Peru, and it probably can be expected in adjacent Brazil.

A description of this species was presented by Standley (1936: 189–190). The inflorescences are relatively small and congested, with the axes rather

short and ascending. The branched portion of the inflorescences (i.e., not including the corollas) is generally 1–1.5 × 1–1.5 cm, and the flowers are so tightly grouped that the arrangement has sometimes been considered capitate though some axes are at least shortly developed. As the inflorescence develops the axes spread and elongate, often markedly, and the branched portion of the infructescences (i.e., not including the fruits) may be up to 2.5 × 6 cm with the secondary axes characteristically longer than the primary axis. The type specimen has presumably been destroyed, but two isotype specimens are extant at F where Standley, the main student of the Neotropical Rubiaceae, worked for many years. One specimen at F is complete and is here chosen as the lectotype; the other is a fragment taken from the holotype that is mounted in a packet on a sheet together with a photograph of the holotype.

The size of the mature infructescences varies, but this variation does not seem to have a strong geographic pattern. The largest infructescences are on plants of the Cordillera del Cóndor region (e.g., *C. Kajekai 1042*, *C. Kajekai 1058*, both at MO). The size of the leaves also is variable, but also without apparent geographic pattern. This species has the longest corollas among the species of *Palicourea* sect. *Didymocarpae*. In fruit this species is similar to *Pal. rhodothamna*, which can be recognized by its shorter calyx limbs, ca. 0.5 mm long versus 1–1.3 mm long in *Pal. cuspidulata*.

9. Palicourea diminuta C. M. Taylor, sp. nov. TYPE: Guyana. Barima-Waini Region: Barima River Head, Eclipse Falls, 5 mi. W Arakaka, 7°38′N, 60°04′W, 20–80 m, 7 Aug. 1986, *J. J. Pipoly & H. Lall 8357* (holotype, MO-4231961; isotype, US not seen). Figure 2C–E.

Haec species a *Palicourea subcuspidata* (Müll. Arg.) C. M. Taylor floribus pedicellatis atque corolla minore lobis abaxialiter laevibus, a *Palicourea acuminata* (Benth.) Borhidi foliis plerumque domatiis carentibus apice longe acuminatis atque corolla minore, ab ambabus inflorescentia minore distinguitur.

Shrubs flowering at 0.5 m tall, to 2.5 m tall; stems glabrous or sparsely puberulous at uppermost nodes. Leaves with blades elliptic, 5–17 × 2–6.5 cm, at base acute to obtuse, at apex acute to acuminate with tips 5–20 mm, drying papyraceous, glabrous and matte on both surfaces; secondary veins 5 to 9 pairs, looping to interconnect, without domatia or occasionally some leaves with a few small pilosulous domatia, on both surfaces costa and secondary veins prominulous, laxly reticulated tertiary venation plane to thickened, and remaining venation not visible; margins plane, entire; petioles 0.3–1 cm, glabrous; stipules persistent, externally glabrous, internally glabrous to pilosulous or pilose with pubescence sometimes borne on stem and visible when stem elongates past sheath, united around stem, sheath truncate, 0.2–0.8 mm, lobes 2 per side, narrowly triangular to linear, 1–3 mm long, acute. Inflorescences terminal, cymose, puberulous, apparently green; peduncle 0.8–2 cm; branched portion corymbiform to broadly pyramidal, 0.8–1.5 × 1.2–2.5 cm, branched to 1 or 2 orders, secondary axes 1 to 3 pairs; bracts reduced or few, scattered, triangular, to 1 mm; pedicels to 1.5 mm. Flowers mixed sessile and pedicellate in dichasial cymules of 5 to 9, biology unknown; hypanthium cylindrical, ca. 0.8 mm, puberulous; calyx limb 0.5–1 mm, puberulous, lobed shallowly or for up to 2/3 its length; corolla in bud broadly rounded to truncate at apex, at anthesis tubular, white to pink, externally puberulous, internally with pilosulous ring in upper part of tube, tube 2.5–3.2 mm, a little swollen at base, straight to weakly curved along its length, lobes triangular, 0.8–1.5 mm, abaxially smooth to thickened; anthers ca. 1 mm, partially exserted or included and positioned in corolla throat; stigmas 0.3–0.5 mm, exserted, positioned just above corolla throat. Infructescences similar to inflorescences except becoming violet or purple and with axes becoming thickened; fruit didymous, 3–4 × 4–6 mm (to 10 × 12 mm in life, e.g., *Henkel et al. 2989*, *Granville et al. 12124*, *Jansen-Jacobs et al. 3343*, *Jansen-Jacobs et al. 3389*), glabrous, violet, blue, or white; pyrenes subglobose, abaxially smooth, adaxially plane with shallow longitudinal groove, with external wall chartaceous to stiffly chartaceous.

Habitat, distribution, and phenology. *Palicourea diminuta* is known from wet forests at 5–900 m in the Guianas, northeastern to southern Venezuela, and northern Brazil, and often grows in swamps or seasonally inundated sites; it has been collected in flower and in fruit all year except December.

IUCN Red List category. *Palicourea diminuta* is assessed as NE.

Discussion. *Palicourea diminuta* can be recognized by its thin-textured leaves, short-truncate stipule sheath, small inflorescences, and quite small corollas that are tubular to weakly funnelform and have the lobes smooth abaxially. The species epithet refers to the small corollas. The flowers seen are all similar in the arrangement of anthers and stigmas, with the anthers positioned in the corolla throat and included or partly exserted and the stigmas held just above the corolla throat. This arrangement agrees

with the long-styled form of some *Psychotria* and *Palicourea* species, and it is possible that *Pal. diminuta* is distylous and its short-styled form has not yet been documented. However, a monomorphic condition cannot be ruled out without more information, probably including field observation.

Palicourea diminuta has been rather commonly collected, but these plants have been included by previous authors variously in *Pal. acuminata* and *Pal. subcuspidata* (Bremekamp, 1934; Steyermark, 1972; Boom & Delprete, 2002; Taylor et al., 2004). *Palicourea subcuspidata* differs from *Pal. diminuta* in its larger corollas with funnelform tubes 4–9 mm long and well-developed horns 0.3–1.1 mm long on the corolla lobes; however, these two species can be difficult to separate in fruit, at least as herbarium specimens. *Palicourea acuminata* in the region where *Pal. diminuta* lives can be recognized by its broadly pyramidal inflorescences with three to five pairs of secondary axes, its truncate to denticulate calyx limbs, its corolla tubes 4–5 mm long that are swollen and bent at the base and curved along their length, its corolla lobes 1.8–2 mm long, and its rather shiny leaves that are rather abruptly acuminate at the apex with slender, often falcate tips; *Pal. acuminata* appears to be uncommon in the Guianas.

Paratypes. BRAZIL. **Pará:** BR 163, Km. 953, Cuiabá–Santarém Hwy., *G. T. Prance, A. S. Silva, M. J. Balick, C. C. Berg, A. J. Henderson, B. W. Nelson, R. P. Bahia & M. R. dos Santos P25380* (MO); Lageira, airstrip on Rio Maicuru, 0°55′S, 54°26′W, *J. J. Strudwick, G. L. Sobel, B. W. Nelson, A. Nazaré Pinheiro, C. da Silva Rosário & N. Alves da Silva 3094* (MO); W bank Rio Maicuru, ca. 23 km upstream from Lageira airstrip, 0°55′S, 54°26′W, *J. J. Strudwick, G. L. Sobel, B. W. Nelson, A. Nazaré Pinheiro, C. da Silva Rosário & N. Alves da Silva 3713* (MO). **Roraima:** Ilha de Maracá, SE tip of island near Ecol. Stat., 3°20′N, 61°25′W, *J. Pruski, D. Campbell, D. Williams, E. Sette Silva & E. Batista 3370* (MO). FRENCH GUIANA. **Région de Saül:** 3°28′N, 53°13′W, *G. Cremers & F. Crozier 14620* (MO); Rivière "Petite Oaqui" = Saut Verdun, *J. J. de Granville 1899* (MO); Fleuve Grand Inini, *J. J. de Granville, L. Allorge, G. Cremers, A. R. A. Görts-van Rijn & J. F. Kodjoed-Bonneton 7354* (MO); Pied du Mont Galbao, entre Crique Canal Panama et Crique [sic], 3°37′N, 53°17′W, *J. J. de Granville, C. Feuillet, L. Hollenberg, O. Poncy & M. Sangrey 8468* (MO); Roche Koutou, bassin du Haut-Marouini, 54°04′N, 2°53′W, *J. J. de Granville, L. Allorge, W. J. Hahn & M. Hoff 9308* (MO); Crique Gabaret-bassin d l'Oyapock, entre l'embouchure et la crique Mérignan, 3°55′N, 51°48′W, *J. J. de Granville 10232* (MO); Roche Touatou, bassin de l'Oyapock, 2°57′N, 52°32′W, *J. J. de Granvile & G. Cremers 12983* (MO); Carbet Gendemerie sur l'Iracoubo, 5.40956°N, 53.26842°W, *O. Lachenaud 924* (MO). GUYANA. Upper Potaro River region, ca. 19 mi. N Kopinang village, 5°05′N, 59°49′W, *B. M. Boom & G. J. Samuels 8898* (MO); Upper Takutu-Upper Essequibo, Kuyuwini River, trail from river to Kassikaityu, 1°55′–2°05′N, 59°06–14′W, *D. Clarke 4383, 4601* (MO); Cuyuni-Mazaruni, Paruima, 5°48′N, 61°03–06′W, *D. Clarke, T. Hollowell, K. David, C. Chin & C. Perry 5214, 5930* (MO); Acari Mtns., 10 km S Sipu River, 1°19′N, 58°57′W, *D. Clarke, R. Williams & C. Perry 7487* (MO); Wassari Mtns., 12 km S S. Kassikaityu River, 1°33′N, 59°14′W, *D. Clarke, R. Williams & C. Perry 8368, 8471* (MO); Potaro-Siparuni Region, upper Potaro River, NE slope of Mt. Wokomung, 5°10′N, 59°47′W, *H. D. Clarke, R. Williams, C. Perry, E. Tripp, J. Kelly, D. Gittens & S. Stern 10978* (MO); Pomeroon-Supernaam, Surumep River, 7°17′N, 58°58′W, *C. Ehringhaus 196* (MO); Upper Takutu-Upper Essequibo, Kuma, ca. 15 km SE Lethem, foot Kanuku Mtns., 3°16′N, 59°43′W, *L. J. Gillespie & D. Gopaul 2037* (MO); Potaro-Siparuni region, 1–3 km SW Paramakatoi, 4°42′N, 59°48′W, *W. Hahn, L. Gillespie & H. Persaud 5645* (MO); Essequibo Island-W. Demerara, lower 7 km Kerite Creek, trib. on W bank Essequibo River, 6°32′N, 58°39′W, *T. W. Henkel & M. Chin 531* (MO); upper White Creek, 3 km SSE mining camp, 6°35′N, 58°43′W, *T. W. Henkel, R. Williams & B. Klein 1911* (MO); Upper Takutu-Upper Essequibo, Kyuywini River watershed, 2–4 km S of Marudi Mountain, 2°13′N, 59°10′W, *T. W. Henkel, R. Williams & B. Klein 2989* (MO); Upper Takutu-Upper Essequibo, SE Kanaku Mtns., S of Crabwood Creek, 2.5 km E Makawatta Mtn., 3°07′N, 59°16′W, *B. Hoffman 383* (MO); NW Kanoku Mtns., 11 km SE Nappi village, 3°21′N, 59°30′W, *B. Hoffmann & R. Foster 3506* (MO); S Pakarama Mtns., 4–5 km E Tipuru Village, 4°13′N, 59°32′W, *B. Hoffman, H. Jacobs & R. Jacobs 1137, 1138* (MO, US); Kanuku Mtns., Rupununi River, Puwib River, 3°07′N, 59°26′W, *M. J. Jansen-Jacobs, C. Feuillet, P. Hiepko, L. E. Skog, B. J. H. ter Welle 318* (MO); Crabwood Creek, 3°07′N, 59°06′W, *M. J. Jansen-Jacobs, B. J. H. ter Welle, A. Chanderbali, U. Raghoenandan & V. James 3343* (MO), *3389* (MO, U); Upper Essequibo region, Rewa River, near Coronal Falls, 3°10′N, 58°40′W, *M. J. Jansen-Jacobs, B. J. H. ter Welle, P. P. Haripersaud, O. Muller & M. van der Zee 5667, 5777* (MO); Berbice River, New Dageraad, 6°02′N, 57°42′W, *P. J. M. Maas, E. A. Menniga, B. J. H. ter Welle & H. J. Groen 5423* (MO); Cuyuni-Mazaruni region, Paruima to Conoch Tipu, S of village, 5°59′N, 61°03′W, *T. McDowell & D. Gopaul 2602* (MO); Potaro-Siparuni, Iwokrama Reserve, Kowkrama Mtns., 4°09′N, 59°02′W, *P. Mutchnick 901* (MO); Barima-Waini Region, Barima River 15 mi. E Arakaka, 7°37′N, 59°54′W, *J. J. Pipoly & H. Lall 8054* (MO), *J. J. Pipoly, H. Lall & J. McIntyre 8082* (MO); head Barima River, Ayambara Falls, 4.5 mi. W of Eclipse Falls, ca. 10 W [sic] of Arakaka, 7°39′N, 60°09′W, *J. J. Pipoly & H. Lall 8205* (MO, US); Upper Demerara-Berbice Region, Mabura Hill Forest Reserve, 5°10′N, 58°42′W, *K. M. Redden, C. Perry & Y. Hawker 1061* (MO); basin Kuyuwini River ca. 150 mi. from mouth, *A. C. Smith 2639* (MO); Quebrada de Akarabisí, a pocos m de la frontera con Venezuela, 6°57′N, 60°22′W, *B. Stergios, G. Aymard & N. Mattheisen 3362* (MO); Tulameng Mtn., 5°32″33′N, 60°57′W, *K. J. Wurdack, K. Redden, S. Alexander, C. Perry, C. Jacobis, D. Hunter, V. Roland & H. Hunter 5326* (MO). SURINAME. Brokopondo, Brownsberg Park, 4°57′N, 55°11′W, *T. B. Croat & G. Ferry 102028* (MO); Confluente Litany-Koule-Koule, Monts Tumuc-Humac, 2°27′N, 54°28′W, *J. J. de Granville, P. Acevedo, A. Boyer & L. Hollenberg 11882* (MO); Inselberg Talouakem, Massif des Tumuc-Humac, 2°29′N, 54°45′W, *J. J. de Granville, P. Acevedo, A. Boyer & L. Hollenberg 12124* (MO); vic. Ulemari River, ca. 150 km upstream from confluence with

Litani River, 2°46′N, 54°51′W, *B. Hammel, S. Koemar & U. Raghoenandan 21567* (MO); Plateau C, 4°49′N, 54°36′W, *M. J. Jansen-Jacobs, J. Behari-Ramdas, A. Grant, G. Ramharrakh, H. ter Steege, O. Bánki, F. van Troon & R. Ho Tsoi 6235, 6345, 6477* (MO); Man Kaba, *M. Sauvain 528* (MO). VENEZUELA. **Bolivar:** 1–10 km W from Río Grande, E El Palmar, *A. Gentry & P. Berry 15013* (MO); 5 km S of El Pauji, Río Samay, affluent of Icabaru, 4°23′N, 61°38′W, *R. L. Liesner & B. K. Holst 18870* (MO); distr. Pilar, Amaruay-tepui, S side, 5°54′N, 62°15′W, *R. Liesner & B. K. Holst 20320* (MO); Reserva For. Imataca, Río Cuyuní entre Isla Anacoco y boca del río Botanamo, *B. Stergios, G. Aymard & A. Herrera 6051* (MO). **Delta Amacuro:** Dept. A. Díaz, a lo largo del caño Orocoima, 75 km al NE de El Palmar, 8°35′N, 61°55′W, *G. Aymard C. 5505* (MO); medio río Grande, 60 km al NE de El Palmar, 8°25′N, 61°45′W, *G. Aymard C. 5391* (MO). **Sucre:** límite distrs. Arismendi/Bermúdez/Benítez, Península de Paria, as SE de Carúpano, al NO de Maturincito, Cerro Cerbatana, 10°38′N, 63°10′W, *W. Meier & P. Molina 6789, 9196* (MO), *W. Meier & C. Mentel 11897* (MO), *W. Meier & J. Thaetner 13838* (MO); Penísula de Paria, headwaters Río Cumaná, SW Cerro de Humo, vic. Manacal, 15 km NW Irapa, 10°41′S, 62°40′W, *J. A. Steyermark & R. Liesner 120682* (MO); distr. Arismendi, Península de Paria, betw. Tacarigua & headwaters of Río Tacarigua, E Cerro Humo, N Río Grande Arriba, 10°41–42′N, 62°36–37′W, *J. A. Steyermark, R. Liesner & V. Carreño E. 121617* (MO).

10. Palicourea huampamiensis (C. M. Taylor) C. M. Taylor, comb. nov. Basionym: *Psychotria huampamiensis* C. M. Taylor, Novon 4(2): 174, fig. 1. 1994. TYPE: Peru. Loreto: Alto Amazonas, Andoas, margen izquierda del Río Pastaza, Campamento OXI, 2°55′S, 76°25′W, 4 June 1981, *R. Vásquez & N. Jaramillo 1896* (holotype, MO-3107464; isotypes, AMAZ not seen, USM).

Habitat and distribution. *Palicourea huampamiensis* is known from wet forests at 125–500 m in the western Amazon basin, in southern Colombia, eastern Ecuador, and northeastern Peru, and it may perhaps be expected in adjacent Brazil.

Discussion. A description and illustration of *Palicourea huampamiensis* were presented by Taylor (1994: 174–175, fig. 1). The inflorescences are narrow and spiciform with the axes reduced or very short, but these axes later elongate, often markedly, as the fruits develop.

11. Palicourea jauaensis (Steyerm.) C. M. Taylor, comb. nov. Basionym: *Psychotria jauaensis* Steyerm., Mem. New York Bot. Gard. 23: 889. 1972. *Psychotria jauensis*, orth. var., Mem. New York Bot. Gard. 23: 524. 1972. TYPE: Venezuela. Bolívar: Meseta de Jáua, Cerro Jáua, cumbre de la porción central-occidental de la Meseta, 36 millas náuticas ó 60 km NW de la misión de Campamento Sanidad del Río Kanarakuni, 1922–2100 m, 22–27 Mar. 1967, *J. A. Steyermark 98098* (holotype, VEN not seen).

Habitat and distribution. *Palicourea jauaensis* is known from montane forests at 2100–2200 m elevation, generally on sandstone substrates, in the Guayana Highlands of southeastern Venezuela.

Discussion. Descriptions of *Palicourea jauaensis* were presented by Steyermark (1974: 1320–1322, fig. 205) and Taylor et al. (2004: 743). Dried specimens of this species very often have a distinctive dark brown color, which is unusual in *Palicourea* though not unknown. Recent collections show a notable range of leaf blade size, 4.5–25 × 2.5–13 cm; leaf size may be related to microsite, with the plants growing variously in sheltered sites or exposed to winds on ridge tops. *Palicourea jauaensis* is similar to and probably closely related to *Pal. ceratantha*, which is found on similar substrates in the same region.

12. Palicourea madidiensis C. M. Taylor, sp. nov. TYPE: Bolivia. La Paz: prov. Nor Yungas, 4.6 km below Yolosa, then 19.1 km on rd. up Río Huarinilla, 16°12′S, 67°53′W, 1700 m, 12 Nov. 1982, *J. C. Solomon 8849* (holotype, LPB digital image; isotype, MO-6328114). Figure 2A, B.

Haec species a *Palicourea subcuspidata* (Müll. Arg.) C. M. Taylor lobis corollinis appendicibus abaxialibus corniformibus carentibus distinguitur; etiam vegetationem montanam habitat.

Shrubs flowering at 1 m tall, to 6 m tall; stems glabrous. Leaves with blades elliptic to narrowly elliptic or ovate, 6.5–26 × 1.5–11 cm, at base acute to obtuse, at apex acuminate with slender often falcate tips 5–30 mm, drying papyraceous to chartaceous, glabrous on both surfaces; secondary veins 9 to 14 pairs, looping to interconnect, with small pilosulous domatia, adaxially costa thinly prominulous, secondary veins and short intersecondary veins thickened to prominulous, and remaining venation plane, abaxially costa and secondary veins prominent, loosely reticulated tertiary venation thickened, and remaining venation plane; margins plane, entire; petioles 0.5–2.3 cm, glabrous; stipules persistent, glabrous, united around stem, sheath truncate, 0.3–1 mm, lobes 2 per side, narrowly triangular, 1.2–3 mm, acute. Inflorescences terminal, paniculate, minutely puberulous to glabrous, apparently green; peduncle 1.5–3.8 cm; branched portion pyramidal, 1.5–4.5 ×

2–4.5 cm, branched to 2 or 3 orders, with 2 to 4 pairs of secondary axes; bracts reduced; pedicels to 1 mm. Flowers sessile and subsessile or sometimes shortly pedicellate in dichasial groups of 5 to 11, distylous; hypanthium ellipsoid to cylindrical, 0.8–1 mm, glabrous; calyx limb 0.1–0.3 mm, glabrous, dentate; corolla in bud truncate at apex, at anthesis tubular-funnelform, white, externally glabrous to puberulous, internally with hirtellous ring near middle of tube, tube 4.5–6 mm, swollen and straight to bent at base, generally straight along its length, lobes triangular, 1.5–2 mm, abaxially smooth except with rough or warty thickening to ca. 0.1 mm; anthers in long-styled form ca. 1.8 mm, subsessile, included and positioned in throat, in short-styled form ca. 2 mm, exserted on developed filaments; stigmas in long-styled form 0.3–0.5 mm, shortly exserted, in short-styled form not seen. Infructescences similar to inflorescences except becoming violet to purple; fruits didymous, ca. 4 × 6 mm, glabrous, white or purple; pyrenes subglobose, abaxially smooth, adaxially plane with longitudinal thickening or groove, with external walls papery to chartaceous.

Habitat, distribution, and phenology. *Palicourea madidiensis* is known from wet forests at 950–1752 m on the eastern slopes of the Andes in northern Bolivia; it has been collected in flower in October and November, and in fruit in January, April through June, and November.

IUCN Red List category. *Palicourea madidiensis* is assessed as NE.

Discussion. *Palicourea madidiensis* is distinguished by its medium-sized (within this group) leaves and inflorescences, medium-sized flowers that are mostly or all sessile to subsessile, corolla lobes without abaxial projections (though there may be warty thickenings), and habitat in premontane and montane forest. *Palicourea madidiensis* is so far only known from the Madidi Region in northern Bolivia, and the species epithet refers to this locality. This new species perhaps may be expected also in adjacent southern Peru, but that region is not well documented. *Palicourea madidiensis* is similar to *Pal. andina* subsp. *andina*, which is also found in the Andes. Future exploration may show these are not separated geographically and have continuous clinal variation in flower size and should be considered one species. However, currently *Pal. andina* can be separated from *Pal. madidiensis* by its generally smaller leaves, 7–16.5 × 1.5–5.5 cm, shorter stipule lobes 0.5–1.2 mm long, inflorescences with some developed bracts, and corolla lobes 2–2.5 mm long. Also, dried specimens of *Pal. andina* generally have a deep reddish purple color versus green to brownish green in *Pal. madidiensis*. One other species of *Palicourea* sect. *Didymocarpae* is known from Bolivia, *Pal. subcuspidata*, which can be recognized by its corolla lobes with well-developed horns 0.3–1.1 mm long and its habitat in warmer lowland vegetation, at 0–800 m.

Paratypes. BOLIVIA. **La Paz:** prov. Bautista Saavedra, Area Nat. Manejo Integrado Apolobamba, Marumpampa, 15°13′S, 68°39′W, *A. Fuentes, R. Cuevas, E. Cuevas & H. Pariamo 7264* (MO); Wayrapata, entre Charazani-Apolo, 15°05′S, 68°29′W, *I. Loza, P. M. Jørgensen, P. Calvi, E. Chura & V. Ramírez 1463A, 1481* (MO); Alto Limón, a 2 días de camino de la comun. San José de Uchipiamonas, yendo a Mamacona por camino de herradura, 14°18′S, 68°05′W, *F. Zenteno, J. Sevillanos & L. Quetewari 1679* (MO); prov. Franz Tamayo, Apolo 57 km hacia Charasani pasando Correo, camp. Calabatea, *S. G. Beck & R. Foster 18489* (MO); Apolo, Salinas–Yanaloma trail, *J. D. Boeke 1473* (MO); Región Madidi, Santo Domingo, sector arroyo Tintaya, 14°47′S, 68°35–36′W, *L. Cayola, G. Chive, I. Loza, N. Chapi & P. Jørgensen 2451, 2453* (MO), *L. Cayola, G. Chive, I. Loza, M. Cornejo, E. Ticona & A. Fuentes 2522, 2536, 2542* (MO); Parque Nac. Madidi, Mojos, camp. Fuertecillo, sobre la senda a Queara, entre Tokoaka & Carjata, 14°36′S, 68°56′W, *L. Cayola, N. Chapi, G. Chive, F. Andia & T. Alvarez 2571* (MO), *A. Fuentes, E. Cuevas & R. Cuevas 9043* (MO), *A. Fuentes, M. Cornejo, E. Ticona, S. Sompero & C. Cuqui 11056* (MO); ca. 30 km E de Rurrenebaque, 5 km S del Río Tuichi, 14°30′S, 67°50′W, *A. Perry 969* (MO); prov. Lacareja, 15.3 km al SO de Guanay por el camino a Tipuani, 15°33′S, 67°58′W, *J. C. Solomon 17660* (MO); prov. Nor Yungas, Cotapata, Estac. Biol. Tunquini, senda a la cascada detrás de ETB, 16°11′S, 67°52′W, *BMA [sic on label] 216* (MO); Alto Corocoro, 9 km al NE de Caranavi, *E. García 511* (MO).

13. Palicourea pandensis (Standl.) C. M. Taylor, comb. nov. Basionym: *Psychotria pandensis* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 11(5): 244. 1936. TYPE: Colombia. [Cundinamarca:] Prov. Bogotá, Fusagasugá & Pandi, 2000 m, 1851–1857, *J. J. Triana 1709* (holotype, P not seen; isotype, F-638791).

Habitat and distribution. *Palicourea pandensis* is known from premontane and montane forests at 900–2400 m in the northern and central Andes, from west-central Colombia to central Peru.

Discussion. Standley (1936: 244–245) presented a description of this species. It is distinctive in the combination of its well-developed bracts, corolla lobes with linear abaxial horns 1.2–2 mm long, didymous fruits, and a usually reddish purple drying color of specimens. *Palicourea pandensis* is apparently not common in any part of its range.

14. Palicourea rhodothamna (Standl.) C. M. Taylor, comb. nov. Basionym: *Psychotria rhodothamna* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(3): 201. 1930. TYPE: Peru. Loreto: Iquitos, 110 m, 3–11 Aug. 1929, *E. P. Killip & A. C. Smith 27115* (holotype, F-607525 digital image).

Subshrubs and shrubs flowering at 0.2 m tall, to 2 m tall; stems glabrous. Leaves with blades elliptic, lanceolate, or ovate, 4.5–23 × 2–9 cm, at base acute to obtuse, at apex acuminate with slender sometimes falcate tips 8–20 mm, drying papyraceous, on both surfaces glabrous; secondary veins 6 to 12 pairs, extending to near margins and then weakly reticulating or weakly looping to interconnect, usually with pilosulous domatia, on both surfaces costa and secondary veins prominent and remaining venation prominulous; margins entire; petioles 0.5–2.5 cm, glabrous; stipules persistent, glabrous, shortly united around stem, sheath truncate to reduced, 0.2–1.2 mm, lobes 2 per side, ligulate to broadly triangular or ovate, 1–3 mm, acute to obtuse, ciliolate. Inflorescences terminal, subcapitate to cymose, puberulous to glabrous, green to white; peduncle 0.4–1.1 cm; branched portion 0.5–1 × 1–2 cm, corymbiform, branched to 2 or 3 orders, secondary axes 2 or 3 pairs; bracts reduced; pedicel to 1 mm. Flowers sessile to pedicellate in dichasial groups of 5 to 7, distylous; hypanthium cylindrical, 0.5–1 mm, glabrous; calyx limb 0.2–0.4 mm, puberulous, truncate to denticulate or lobed for up to 1/3 its length; corolla in bud obtuse at apex, at anthesis slenderly funnelform, yellow-white, cream, or pale green, externally puberulous, internally glabrous except with hirtellous ring near middle of tube, tube 9–13 mm, weakly bent and swollen at base, straight to usually curved along its length, lobes narrowly triangular, 3–4 mm, abaxially smooth or with warty thickening to 0.2 mm high; anthers in long-styled form ca. 2 mm, included and positioned near middle of tube, in short-styled form ca. 2.2 mm and exserted; stigmas in long-styled form ca. 1 mm and exserted, in short-styled form ca. 2 mm and positioned near middle of corolla tube. Infructescences similar to inflorescences except becoming purple-violet with axes markedly thickened; fruits didymous, ca. 7 × 5 mm, glabrous, blue-black; pyrenes subglobose, abaxially smooth, adaxially plane with longitudinal groove, with external walls thickly chartaceous.

Habitat, distribution, and phenology. *Palicourea rhodothamna* is known from wet and premontane forests at 100–1500 m in the western Amazon basin, sometimes on white sand substrates, from southern Colombia to central Peru and north-central Brazil; it has been collected in flower July through November and in fruit January through August and October through December.

Discussion. *Palicourea rhodothamna* is circumscribed differently here than by previous authors (e.g., Standley, 1936: 207; Taylor, 1997b: 630), who included in *Pal. rhodothamna* some plants here separated into *Pal. cuspidulata*. *Palicourea rhodothamna* and *Pal. cuspidulata* are similar in aspect, especially in fruit; *Pal. cuspidulata* can be recognized by its longer calyx limbs, 1–1.3 mm long, and corolla lobes with abaxial horns 0.3–1 mm long versus calyx limbs ca. 0.5 mm long and corolla lobes abaxially smooth or a little thickened in *Pal. rhodothamna*. Plants from the Ducke Reserve in north-central Brazil that were treated by Taylor et al. (2007) as *Psychotria cornigera* (= *Pal. subcuspidata*) are here re-identified as *Pal. rhodothamna*; that description was based on some plants of *Pal. subcuspidata* as well, and thus is not completely accurate for either species. *Palicourea subcuspidata* can be recognized by its corollas with generally shorter tubes 4–9 mm long and well-developed horns 0.3–1.1 mm long on the lobes.

Representative specimens studied. BRAZIL. **Amazonas:** Reserva Florestal Ducke, Manaus–Itacoatiara Km. 26, 2°53′S, 59°58′W, *M. T. V. do Campos & P. A. C. L. Assunção 609* (MO), *J. L. Santos & R. P. de Lima 849* (MO). COLOMBIA. **Amazonas:** dept. Pto. Nariño, Parque Nac. Nat. Amacayacu, 3°48′S, 70°18′W, *A. Gentry & J. A. Villa-Lopera 60801* (MO); 3°45′S, 70°18′W, *R. Vásquez, A. Tye, M. Amaya & N. Jaramilo 12600* (MO). **Putumayo:** mpio. Mocoa, correg. Pto. Limón, márgen derecha del Río Caquetá, *L. J. Rubiano & C. Moreno O. 342* (MO). ECUADOR. **Morona-Santiago:** cantón Tiwintza, parroq. Yaui, Cordillera Shaime, E of Centro Shuar Jempeket, 5–10 km N Patuca–Shaime rd., 2°59′S, 78°48′W, *J. L. Clark, D. Menuz, S. Quinn, A. Wilsum & R. Naikai 9211* (MO). **Orellana:** cantón Orellana, Reserva Etnica Huaorani, comun. Miwanguno a 140 km S del Coca, via al Pindo, 0°44′S, 76°44′W, *B. Freire & D. Naranjo 640* (MO). **Pastaza:** Río Curaray, boca del Río Queremo, 1°30′S, 76°32′W, *W. Palacios & D. Neill 739* (MO). **Sucumbíos:** along rd. Baeza–Nuevo Loja (Lago Agrio), 67 km E Baeza, 0°10′S, 77°41′W, *T. B. Croat 72479A* (MO). **Zamora-Chinchipe:** vic. mining camp at Río Tundaime, rd. to military base El Condor, *H. van der Werff, B. Gray, J. C. Ronquillo & W. Quizhpe 19394* (MO). PERU. **Amazonas:** Bagua, 81 k m NE Chiriaco, parcelación Monterrico, 4°45′S, 77°58′W, *S. Knapp & P. Alcorn 7605* (MO). **Loreto:** prov. Maynas, Indiana, Reserva

Explorama, Quebrada Yanamono, 8°28′S, 72°50′W, *R. Vásquez, R. Ortíz & N. Jaramillo 14156* (MO). **San Martín:** prov. Lamas, Santa Rosa de Davidcillo, Tarapoto–Yurimaguas rd. Km. 72, *S. Knapp 8234* (MO).

15. Palicourea sanluisensis C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: mpio. San Francisco, correg. Aquitania, Alto del Venado (Tierra Linda), 1200–1350 m, 2 Apr. 1992, *R. Fonnegra & Curso de Taxonomía de Plantas Vasculares Semestre I/92 4005* (holotype, HUA-81193 digital image; isotype, MO-04674854). Figure 1D–H.

Haec species a *Palicourea acuminata* (Benth.) Borhidi inflorescentia longiore axibus validioribus atque foliis crassioribus plerumque majoribus marginibus cartilagineis evolutis, a *Palicourea cuspidata* (Bredem. ex Schult.) C. M. Taylor lobis corollinis abaxialiter laevibus distinguitur; etiam aliter a hac locos calidiores habitat.

Shrubs and small trees flowering at 1 m tall, to 6 m tall; stems glabrous. Leaves with blades elliptic to ovate, 10–25 × 4–13 cm, at base acute to obtuse, at apex acuminate with slender often falcate tips 8–35 mm, drying stiffly papyraceous to chartaceous, on both surfaces glabrous; secondary veins 10 to 16 pairs, extending nearly to margins and then weakly reticulating with other veins or with margins, with a few small pilosulous domatia, adaxially costa and secondary veins prominulous and remaining venation plane or tertiary venation sometimes thickened, abaxially costa prominent, secondary veins prominulous, tertiary venation loosely reticulated and thinly prominulous, and remaining venation plane and not visible; margins plane, entire; petioles 0.8–3.5 cm, glabrous; stipules persistent, glabrous, united around stem, sheath truncate, 0.8–2 mm, with lobes 2 per side, triangular, 0.8–1.5 mm, acute to obtuse. Inflorescences terminal, paniculate, puberulous to glabrous, apparently green; peduncle 1.5–4 cm; branched portion pyramidal to broadly pyramidal, 3–7 × 3–9 cm, branched to 2 or 3 orders, secondary axes 3 to 6 pairs; bracts reduced or few, linear to narrowly triangular, to 0.5 mm; pedicels to 1.5 mm. Flowers mixed sessile and shortly pedicellate in dichasial cymules of 5 to 9, distylous; hypanthium cylindrical, ca. 0.8 mm, glabrous to puberulous; calyx limb 0.2–0.5 mm, puberulous to glabrous, truncate to denticulate; corolla in bud truncate at apex, at anthesis funnelform, white to yellow, externally puberulous, internally with pilosulous ring near middle of tube, tube 4.5–5 mm, generally bent and weakly swollen at base, straight to curved along its length, lobes triangular, ca. 2 mm, abaxially almost smooth with rounded thickening to 0.1 mm high; anthers in long-styled form ca. 1 mm, included and positioned just below corolla throat, in short-styled form ca. 1.5 mm, exserted; stigmas in long-styled form 0.2–0.3 mm, exserted, in short-styled form not seen. Infructescences similar to inflorescences except becoming red-purple; fruit didymous, 4 × 5–7 mm, glabrous, blue, purple, or gray; pyrenes subglobose, abaxially smooth, adaxially plane with shallow longitudinal groove, with external walls chartaceous.

Habitat, distribution, and phenology. *Palicourea sanluisensis* is known from wet forests at 430–1350 m on eastern slopes of the Cordillera Central of the Andes in the lower Magdalena River valley in northwestern Colombia, often and perhaps generally on sandstone substrates; it has been collected in flower March and April, and in fruit in May, June, and September through December.

IUCN Red List category. *Palicourea sanluisensis* is assessed as NE.

Discussion. *Palicourea sanluisensis* can be recognized within *Palicourea* sect. *Didymocarpae* by the combination of its relatively robust leaves and inflorescences, corolla lobes without developed horns, and habitat on sandstone substrates in northern Colombia. This species is known from a small area of the lower Magdalena River drainage, where it has been documented mainly from the municipality of San Luis; the species epithet refers to this place. Some other Rubiaceae are also known only from the lower Magadalena basin, which appears to have a high degree of local endemism (e.g., *Ciliosemina purdieana* (Wedd.) Antonelli, *Coussarea antioquiana* C. M. Taylor, *Simira hirsuta* C. M. Taylor). These species apparently preferentially are found on these substrates, but this region is poorly known floristically.

Palicourea sanluisensis is similar to *Pal. cuspidata* and *Pal. acuminata*; however, both of these can be recognized by their inflorescences with more slender axes and their thinner-textured, generally smaller leaves. Additionally, *Pal. cuspidata* can be recognized by its corolla lobes with well-developed horns and habitat usually at higher elevations. The separation of *Pal. sanluisensis* from the other species may deserve further study.

Paratypes. COLOMBIA. **Antioquia:** Quebrada La Cristalina, 6°N, 74°45′W, Sector SE, 770–500 m, *J. G. Ramírez & D. Cárdenas L. 716* (MO); mpio. Nariño, ver. Puente Linda, margen izquierda del río Samaná, 5°34′N, 75°03′S, 700–960 m, *R. Fonnegra & Estudiantes de Taxonomía Plant. Vasc. Sem. 11/94 5102* (MO); mpio. San Luis, correg. El Prodigio, camino El Prodigio a la hacienda El Tigre,

6°06′N, 74°48′W, *D. Cárdenas L., J. G. Ramírez & A. Osorno 2957* (MO); ver. El Portón, margen derecha del río Samaná, camino autopista Medellín–Bogotá, 5°57′N, 74°57′W, *D. Cárdenas L., J. G. Ramírez & J. Mejía 2489* (MO); ver. La Josefina, autopista Medellín–Bogotá, sector Río Samaná–Río Claro, margenes Quebrada La Salada, 6°00′N, 74°55′W, *A. Cogollo & J. G. Ramírez 4313* (MO); Quebrada la Mariola, 6°00′N, 74°55′W, *D. Cárdenas & J. G. Ramírez 2736* (MO); Finca Palmira, 75°05′N, 5°53′W, *R. Fonnegra, F. A. Cardona, G. Vélez & Curso de Taxonomía Sem. II/96 6361* (MO); camino Palmira, *S. Hoyos & J. Hernández 410* (MO); camino del caño La Mariola hacia Santa Bárbara, *S. Hoyos & J. Hernández 582* (MO); ver. San Pablo, Quebrada Carbonera, Finca Aquelarre, 6°03′N, 75°06′W, *R. Fonnegra & W. Rengifo M. 4895* (MO).

16. Palicourea spicata (Kuntze) C. M. Taylor, comb. nov. Based on: *Uragoga spicata* Kuntze, Revis. Gen. Pl. 2: 962. 1891, replacement name. *Psychotria spicata* Müll. Arg., Flora 59: 550. 1876, hom. illeg., not *Psychotria spicata* Benth., 1841. *Psychotria spiciflora* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 7(1): 115. 1930, replacement name. TYPE: Brazil. Amazonas: in prov. Alto Amazonas ad Rio Negro prope San Carlos, 1853–1854, *R. Spruce 3089* (holotype, BR-532-648 digital image; isotypes, E-285076 digital image, K-174361 digital image, NY-132829 digital image, WU not seen).

Psychotria vaupesana Standl. ex Steyerm., Acta Biol. Venez. 4: 101, fig. 50. 1964. TYPE: Colombia. Vaupés: Cerro Circasia, 200 km arriba Mitú, 10 Oct. 1939, *J. Cuatrecasas 7182* (holotype: F-1044521 digital image; isotypes, COL-18838 digital image, COL-18839 digital image, US-1797532 digital image).

Habitat and distribution. *Palicourea spicata* is known from wet forests at 50–200 m in the northern Amazon basin, in southwestern Venezuela, southern Colombia, northeastern Peru, and probably adjacent Brazil.

Discussion. Descriptions of *Palicourea spicata* were presented by Steyermark (1974: 1270–1273, fig. 191) and Taylor et al. (2004: 758). This species was included by Steyermark (1972) in *Psychotria* sect. *Chytropsia*, a species group that was transferred to *Margaritopsis* by Taylor (2005) with the exception of this one species. *Palicourea spicata* was originally described as *Psy. spicata* Müll. Arg., but that name is a later homonym and thus illegitimate (although that status has not always been noted by subsequent authors). Mueller's species was subsequently transferred into *Uragoga*, but because its name was illegitimate, the name *U. spicata* is a replacement name published in a different genus rather than a combination based on Mueller's name. The name *U. spicata* appears to be the oldest legitimate name available for this species. Standley (1930) also recognized the illegitimate status of Mueller's name and published an avowed substitute name, *Psy. spiciflora*. It is not clear if Standley was aware of the previously published replacement name *U. spicata*, but the epithet "spicata" was blocked in *Psychotria* by the same name that blocked Mueller's name so he could not transfer Kuntze's name into *Psychotria* either. This epithet is not blocked in *Palicourea*, however.

17. Palicourea subcuspidata (Müll. Arg.) C. M. Taylor, comb. nov. *Psychotria subcuspidata* Müll. Arg., Fl. Bras. 6(5): 261. 1881. *Uragoga subcuspidata* (Müll. Arg.) Kuntze, Revis. Gen. Pl. 2: 962. 1891. TYPE: Brazil. Amazonas: in regione amazonica inter Santarem et Barra do Rio Negro, Oct. 1850, *R. Spruce Psychotria (3) n. 991* (holotype, BR not seen; isotypes, G[00300809] digital image, NY[00136836] digital image).

Declieuxia psychotrioides DC., Prodr. 4: 481. 1830, not *Palicourea psychotrioides* (C. M. Taylor & Hammel) C. M. Taylor. TYPE: French Guiana, s.d., *Patris s.n.* (lectotype, designated here, G-DC neg. 6659 microfiche, G-DC neg. 6659 as photo F neg. #6659 at MO; isolectotype, G-DC microfiche).

Psychotria cornigera Benth., J. Bot. (Hooker) 3: 227. 1841, not *Palicourea cornigera* C. M. Taylor, 1997. *Uragoga cornigera* (Benth.) Kuntze, Revis. Gen. Pl. 2: 960. 1891. *Psychotria bahiensis* var. *cornigera* (Benth.) Steyerm., Mem. New York Bot. Gard. 23: 518. 1972. TYPE: British Guiana [Guyana], 1837, *R. Schomburgk 251* (holotype, K[000173407] digital image; isotypes, F-734130 digital image, TCD-5785 digital image, US-702604 digital image).

Habitat and distribution. *Palicourea subcuspidata* is known from wet forests at 0–800 m in the Guianas, southern Venezuela, northern to west-central Brazil, and Amazonian Peru and Bolivia.

Discussion. As discussed in the introductory portion of this article, Steyermark (1972) treated these plants as *Psychotria bahiensis* var. *cornigera*, but they are here separated from *Psy. bahiensis* following Taylor et al. (2004). Steyermark described *Psy. bahiensis* var. *cornigera* there (1972: 440, couplet 381) as having sessile flowers, but that description applies to *Psy. bahiensis*, while the flowers of *Palicourea subcuspidata* are variously sessile to pedicellate, with pedicels to 1 mm long and both positions present and mixed on an individual inflorescence.

Palicourea subcuspidata as circumscribed here is found widely across the Amazon basin, and varies a bit morphologically across this range but without enough apparent pattern to identify infraspecific

groups. The length and degree of lobing of the calyx limb vary from ca. 0.2 mm long and subtruncate to ca. 0.5 mm long and lobed for up to half its length, and this variation shows no apparent geographic pattern or correlation with other features. The horns on the corolla lobes vary from 0.3 to 1.1 mm long, and this variation also shows no apparent geographic pattern or correlation with other features. In some plants from the Guianas, Venezuela, and Brazil, the inflorescence bracts are few, reduced, and irregularly distributed along the inflorescence axes or are sometimes completely lacking (e.g., *S. Lowrie et al. 171*, *198*, Acre, Brazil; *G. Aymard & L. Delgado 8376*, Amazonas, Venezuela, all at MO); these match the type specimen of *Psychotria cornigera*. Other plants from the Guianas, southern Venezuela, Brazil, eastern Peru, and northeastern Bolivia have regularly developed and distributed bracts (e.g., *R. Foster 5792*, *R. Foster et al. 11781*, Madre de Dios, Peru; *C. C. Berg et al. 602*, *750*, Pará, Brazil; *G. Aymard & L. Delgado 8193*, Amazonas, Venezuela, all at MO); these plants match the type of *Psy. subcuspidata*. Some other specimens from Venezuela are intermediate, with a few small, regularly distributed bracts (e.g., *G. Aymard & L. Delgado 8440*, Amazonas, Venezuela; *E. Sanoja 2345*, Bolívar, Venezuela, both at MO). Corolla size also varies and does show a continuous, weakly clinal pattern, with no clear differences between regional populations but the flowers trending smaller in the northern part of this species's range and larger in the southern part.

Palicourea subcuspidata is similar to and frequently confused with *Pal. acuminata*; their distinctions are outlined in the discussion of *Pal. acuminata*. Plants from the Ducke Reserve in north-central Brazil that were treated by Taylor et al. (2007) as *Psychotria cornigera* are here re-identified as *Pal. rhodothamna*; that description is not accurate for either species. *Palicourea rhodothamna* can be recognized by its corollas with generally longer tubes 8–11 mm long without horns on the lobes. *Palicourea subcuspidata* is also similar to *Pal. diminuta*; their distinctions are outlined in the discussion of *Pal. diminuta*. Also similar in having corollas with well-developed abaxial horns is *Pal. cuspidata*; see the discussion under that species for its separation.

The name *Declieuxia psychotrioides* was originally included in *Declieuxia* Kunth only provisionally and was based on two syntype collections, a Patris collection from Cayenne and a Haenke collection from "Panama and Mexico" (de Candolle, 1830: 481). This name was synonymized by Steyermark (1972) with *Psychotria bahiensis* var. *bahiensis*, even though its description is very general and he did not report seeing original material. In his revision of *Declieuxia*, Kirkbride (1976) excluded this name from this genus and reported Steyermark's citation of this name in synonymy with *Psy. bahiensis*. Steyermark (1972: 517–518) cited the Patris collection as the type of this species without stating this was a lectotypification or mentioning the other syntype; in this same work, he clearly identified his intentional lectotypifications as such. Steyermark's work was a floristic study of South American *Psychotria*, and the mention of the Central American syntype may have been outside the scope of his work, or he may have overlooked it; which of these is the case cannot be determined. Thus, Steyermark's citation does not seem to be an intentional or effective lectotypification; in any case, it was inadequate because there are two duplicate specimens at G-DC of the Patris collection that he did not separate. The Haenke collection is better documented with photos and duplicate specimens (MO-5469976, W not seen, W as photo F neg. #31144 at MO, WU not seen 2 sheets), and even though its collection locality is vague, it clearly is *Palicourea acuminata*. The identity of the Patris specimen is less clear because it is in fruit, but it seems to be *Pal. subcuspidata* based on leaf characters. The Patris collection is preferable as the lectotype because it is deposited in de Candolle's own herbarium and has been considered the type based on Steyermark's work. The specimen of this collection at G-DC with the larger plant sample, labeled in the microfiche image with a ruler that says "6659," is here chosen as the lectotype; the smaller specimen at G-DC that is labeled "Cayenne" is here designated as the isolectotype. The epithet "psychotrioides" is blocked from transfer into *Palicourea*, so a change in the species identification of this lectotype will not change the name of any species of *Palicourea*.

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Two New Species of Andean Tuberous *Begonia* in the *B. octopetala* Group (Begoniaceae)

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Abstract. A morphologically distinct group of 10 species within the *Begonia* L. sect. *Eupetalum* (Lindl.) A. DC. is identified and informally named as the *B. octopetala* L'Hér. species group. Two new species of *Begonia* (Begoniaceae) are described and illustrated from this group. The new species *B. pseudopleiopetala* Tebbitt is based upon type material collected from the Cajamarca region in Peru and is also known from the Piura region of Peru; the second new species *B. marinae* Tebbitt is based upon type material collected from the Santa Cruz Department in Bolivia and is also known from La Paz, Chuquisaca, and Tarija departments, Bolivia, as well as the province of Salta in adjacent Argentina. A taxonomic synopsis of *B. octopetala* and a description of one additional species from this species group, *B. pleiopetala* A. DC., are also provided for comparison. *Begonia gracillima* A. DC. and *B. tenuicaulis* A. DC. are newly synonymized with *B. pleiopetala*. Lectotypes are provided for *B. gracillima* [= *B. pleiopetala*], *B. pusilla* A. DC. [= *B. pleiopetala*], *B. tenuicaulis* [= *B. pleiopetala*], and *B. warburgiana* Hieron. [= *B. pleiopetala*].

Resumen. Un grupo morfológicamente distintos de 10 especies dentro de la *Begonia* L. sección *Eupetalum* (Lindl.) A. DC. es identificado y nombrado informalmente el grupo de especies *B. octopetala* L'Hér. Dos nuevas especies de *Begonia* (Begoniaceae) se describen e ilustran de este grupo. La nueva especie *B. pseudopleiopetala* Tebbitt se basa en material de tipo recogido de la región de Cajamarca, en Perú, y también se conoce de la región de Piura de Perú; la segunda especie de nuevos *B. marinae* Tebbitt se basa en material de tipo recogido en el departamento de Santa Cruz, en Bolivia, y también se conoce de La Paz, Chuquisaca y departamentos de Tarija, Bolivia, así como de la provincia de Salta en Argentina adyacente. Una sinopsis taxonómica de *B. octopetala* y una descripción de una de las especies adicionales de este grupo de especies, *B. pleiopetala* A. DC., también se proporcionan para su comparación. *Begonia gracillima* A. DC. y *B. tenuicaulis* A. DC. han sido recientemente sinonimizado con *B. pleiopetala*. Lectotipos se proporcionan para *B. gracillima* [= *B. pleiopetala*], *B. pusilla* A. DC. [= *B. pleiopetala*], *B. tenuicaulis* [= *B. pleiopetala*] y *B. warburgiana* Hieron. [= *B. pleiopetala*].

Key words: Argentina, *Begonia*, Bolivia, Cajamarca, IUCN Red List, Peru, Santa Cruz.

Two new species of *Begonia* L. were identified during an ongoing monographic study of *Begonia* sect. *Eupetalum* (Lindl.) A. DC., which comprises an estimated 40 species. The members of this section together with *B. boliviensis* A. DC. of section *Barya* (Klotzsch) A. DC. form a monophyletic group (Tebbitt & Stuart, unpub.), which are often referred to colloquially as the tuberous begonias on account of their tuberous rootstocks, unique among Andean *Begonia*. The two new species described here along with eight other species, viz. *B. aequatorialis* L. B. Sm. & B. G. Schub., *B. anemoniflora* Irmsch., *B. octopetala* L'Hér., *B. pleiopetala* A. DC., *B. polypetala* A. DC., *B. rosacea* Putz., *B. rubricaulis* Hook., and *B. tumbezensis* Irmsch., constitute an informal group within *Begonia* sect. *Eupetalum*. This species group can be distinguished from the remainder of *Begonia* sect. *Eupetalum* by virtue of having a combination of multifid (vs. bifid) styles, symmetric leaf blades, an acaulous habit, and, in most members of the group, more asymmetric ovary wings and a tendency to have more numerous tepals (up to 12 tepals in the male flowers vs. up to six and up to 11 tepals in the female flowers vs. up to six). Several members of this species group share greatest morphological similarity with *B. octopetala*, which is a widespread and variable taxon found in both Ecuador and Peru. Many of these species also have distributions that are parapatric with *B. octopetala* and accordingly may represent segregate species derived from it. This group is informally referred to herein as the *B. octopetala* species group.

Begonia pseudopleiopetala Tebbitt, as described herein, was originally identified as a new species, following an extensive herbarium-based study of Andean *Begonia*. Several of the specimens of this species were previously misidentified as *B. pleiope-*

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tala. *Begonia pleiopetala* is widespread and locally common in the Andes of Peru (Tumbes, Huánuco, Huancavelica, Cusco, Puno regions) and northern Bolivia (La Paz Department), while *B. pseudopleiopetala* apparently has a much more restricted distribution being known from only a few collections made in the vicinity of Contumazá, Peru (Cajamarca region), and from a single collection made near Huancabamba, Peru (Piura region). The two species are morphologically similar and likely represent sister species. Parallel descriptions of both species are provided herein for comparison. Smith and Schubert (1945) list *B. pusilla* A. DC. and *B. warburgiana* Hieron. as synonyms of *B. pleiopetala* but with question marks before their names. Barkley and Golding (1974), based on this citation, included both these taxa as unquestionable synonyms of *B. pleiopetala*, a practice that latter authors (e.g., Golding & Wasshausen, 2002) have followed. Study of herbarium material found that *B. pusilla* and *B. warburgiana*, as well as *B. gracillima* A. DC. and *B. tenuicaulis* A. DC., are morphologically supported as taxonomic synonyms of *B. pleiopetala*. The second new species, *B. marinae* Tebbitt, was identified during fieldwork conducted in Bolivia during January 2012 and 2013. It, too, is likely most closely related to *B. pleiopetala*. To aid identification of these poorly studied *Begonia*, a key to the *B. octopetala* species group is provided.

Key to *Begonia octopetala* Species Group of Andean South America

Organ lengths are here measured from the apex of an organ to its point of attachment. Width is measured as the distance from one side of an organ to the other at its widest part.

1a. Margin of 2 outermost tepals of male (and often also female) flowers denticulate or ciliate-denticulate; male tepals 4 to 6 2
  2a. Leaf adaxial surface glabrous; bract margin ciliate-dentate or laciniate-dentate toward the apex; female tepals five, 0.9–2.5 cm long; Ecuador (Loja) and Peru (Tumbes, Cajamarca, La Libertad) ..... *B. tumbezensis* Irmsch.
  2b. Leaf adaxial surface with a sparse to dense cover of short hairs; bract margin usually entire, rarely sparsely fimbriate along the entire length; female tepals usually 6, occasionally five, 0.5–1 cm long; eastern Andean Venezuela and Colombia ..... *B. rosacea* Putz.

1b. Margin of 2 outermost tepals of male and female flowers entire; male tepals 4 to 11 3
  3a. Leaf undersurfaces, petioles, peduncles, pedicels, and ovaries covered with white reflective hairs, often densely so 4
    4a. Plant surfaces canescent-pubescent; leaf blade deltoid; tepals blood red, apex usually acute or rarely obtuse, never emarginate; northern Andean Peru (Piura) ..... *B. polypetala* A. DC.
    4b. Plant surfaces tomentose; leaf blade broadly ovate to orbicular or subreniform; tepals white or pink, apex obtuse and sometimes distinctly emarginate 5
      5a. Male tepals (6)7 or 8, uniformly bright pink, apex obtuse but never emarginate; leaf blade 3.5–16 × 3.5–13 cm; ovary with 2 prominent bracteoles situated at its base; Andean Bolivia (La Paz, Chuquisaca, Santa Cruz, and Tarija) and Argentina (Salta) ..... *B. marinae* Tebbitt
      5b. Male tepals 10 or 11, outermost pink, innermost white, apex obtuse and distinctly emarginate; leaf blade 2.3–4.3 × 3.2–6.5 cm; ovary lacking bracteoles; central Andean Peru (Pasco, Junin) ..... *B. anemoniflora* Irmsch.
  3b. Leaf undersurfaces, petioles, peduncles, pedicels, and ovaries glabrous to pubescent, hairs (when present) not forming a white reflective surface 6
    6a. Inflorescence symmetric to subsymmetric, once- or twice-branched; leaf blade 6.5–27 cm wide; outermost tepals of male flowers 0.5–2.7 cm wide 7
      7a. Innermost whorl of male tepals spatulate; female tepals 6 or 7; western Andean Ecuador to central Andean Peru and coastal lomas of northern Peru ..... *B. octopetala* L'Hér.
      7b. Innermost whorl of male tepals broadly elliptic to elliptic or ovate; female tepals 5 or 6; northeastern Andean Argentina ..... *B. rubricaulis* Hook.
    6b. Inflorescence asymmetric, unbranched; leaf blade 1.5–13 cm wide; outermost tepals of male flowers 0.3–1.1 cm wide 8
      8a. Apex of leaf blade abruptly acuminate; anther connective never projecting beyond the thecae; female tepals 5; western Andean Peru (Cajamarca and Piura) ..... *B. pseudopleiopetala* Tebbitt
      8b. Apex of leaf blade acute to obtuse; anther connective usually projecting beyond the thecae, occasionally not projecting beyond the thecae; female tepals 6 to 9 9
        9a. Leaf blade triangular-ovate; female tepals 6; central and southern Andean Ecuador and northern Andean Peru ..... *B. aequatorialis* L. B. Sm. & B. G. Schub.
        9b. Leaf blade ovate to orbicular; female tepals 7 to 9; Andean Peru and northern Andean Bolivia ..... *B. pleiopetala* A. DC.

Taxonomic Treatment of the *Begonia octopetala* Group, Pro Parte

1. Begonia marinae Tebbitt, sp. nov. TYPE: Bolivia. Santa Cruz: Vallegrande, rd. from Pucara to Alto Seco, N & NE facing open slopes in remnant Tucomano forest, 18°44′S, 64°06′W, 2727 m, 12 Jan. 2012, *M. C. Tebbitt 724* (holotype, USZ; isotypes, USZ [2]). Figure 1.

Diagnosis. Related to *Begonia pleiopetala* A. DC., but differs especially by the leaf blades with a dense cover of white tomentose hairs adaxially, tepals bright pink (vs. white or pale pink), tepals broader in the male flowers (1.3–2.2 vs. 0.15–0.8 [–1.1] cm), and ovaries with two prominent bracteoles and a larger body (0.8–1 × 0.75–1.2 vs. 0.3–0.7 × 0.3–0.55 cm).

Acaulous tuberous herb; tuber ellipsoid, 3.5–8 cm diam., 2–4 cm tall; stipules persistent, membranous, ovate to oblong-ovate, 1–2 × 0.8–1.5 cm, apex rounded, shortly aristate, margin entire. Leaves 1 to 3, alternate, arising toward one end of tuber, basifixed; petiole orientated in same direction as main vein of blade, 4–12 cm, pale green and often developing a reddish tinge in proximal half, covered with dense, short white-tomentose hairs; blades ± symmetric, orbicular to ovate-orbicular, 3.5–16 × 3.5–13 cm, apex acute or obscure, base ± symmetric, cordate, basal lobes overlapping or not and then to 1 cm apart, sinus 2–5.5 cm deep, margin dentate, teeth triangular, 2–10 mm, ciliate, adaxial blade surface pale green, sparse to moderate indument of short white-downy hairs, abaxial blade surface pale green but coloration obscured by dense indument of short white-tomentose hairs, veins palmate, impressed on adaxial surface, slightly raised on abaxial surface, (6 to)9. Inflorescences 1 or 2, erect, bisexual, asymmetric, cymose, usually bearing 2 male and 2 female flowers; peduncle reddish green, 14–34 cm, moderately to densely covered with white-tomentose hairs; pedicels of male flowers 2–6.8 cm, color and indument as in peduncle; pedicels of female flowers 1.5–5.2 cm, color and indument as in peduncle; bracts persistent, pink when young but soon becoming brown and dry, narrowly ovate to narrowly oblong-ovate, 1–2.3 × 0.4–0.8 cm, apex acute, margin entire, outer surfaces with a moderate covering of white-tomentose hairs, inner surfaces glabrous. Male flowers with tepals spreading, (6)7 or 8, bright pink, outer pair elliptic, 2–2.6 × 1.3–2.2 cm, apex obtuse, folded longitudinally and somewhat U-shaped in cross-section, base rounded, margin entire, outer surfaces of outermost pair of tepals sparsely to moderately white-tomentose, inner surfaces glabrous, inner 5 or 6 tepals spatulate, 2.2–3 × 1–1.7 cm, apex obtuse, folded longitudinally and somewhat U-shaped in cross-section, base attenuate, margin entire; stamens yellow, ca. 200, attached along length of a ca. 5 mm tall torus; filaments 2–3 mm; anthers obovate, ca. 1 mm, dehiscing via short lateral slits, connective not projecting, symmetrically basifixed to filaments. Female flowers with 2 bracteoles, both situated at ovary base but one bracteole inserted slightly lower than the other and this proximal bracteole also slightly larger in size, bracteoles pink when young becoming brown, ovate, elliptic-obovate or elliptic-ovate, 8–10 × 4.5–10 mm, outer surfaces moderately tomentose, with short, white hairs, inner surfaces glabrous, tepals persisting in fruit, spreading, 6 to 11, color similar to male tepals, outer surfaces with a moderate covering of white-tomentose hairs, inner surfaces glabrous, outer 3 tepals elliptic to broadly obovate, 1.5–2 × 1–1.6 cm, apex obtuse, base attenuate, margin entire, inner 3 to 8 tepals broadly obovate to elliptic, 1.5–1.6 × 1–2.6 cm, apex obtuse, base attenuate, margin entire, both surfaces glabrous; ovary body ± orbicular, 0.8–1 × 0.75–1.2 cm, densely white-tomentose, 3-winged, one wing slightly longer than the other two, longest wing narrowly triangular, front edge of wing truncate, apex obtuse, 0.1–1(–2.5) cm tall, 0.75–1.1 cm broad, shorter wings riblike, to 5 mm tall, ovary 3-locular, placentas axile, bifid; ovules arranged on both surfaces; styles 3, ca. 6 mm tall, yellow, shortly fused at the base, multifid, branches somewhat erect, with stigmatic papillae in a spirally twisted band toward ends of style branches. Fruit a capsule, densely covered with white-tomentose hairs, similar in shape and size to ovary.

Distribution and ecology. *Begonia marinae* is scattered but often locally abundant in Bolivia's eastern Chuquisaca Department and neighboring Santa Cruz, as well as in southeastern La Paz and southern Tarija. In the latter department, the species occurs along the western edge of the Reserva Nacional de Flora y Fauna, Tariquía, and along the Cuesta de Sama in the Reserva Biológica de la Cordillera de Sama. The species is also known from two collections from Argentina's Salta Province.

In Bolivia, plants of *Begonia marinae* were observed as growing on open, grassy slopes, often amongst remnant Tucomano forest, at altitudes of 2200–3600 m. I have not observed wild populations in Argentina, but the species is recorded to grow there at 3500–3600 m (*Sleumer 3815*) and likely occurs in similar habitat.

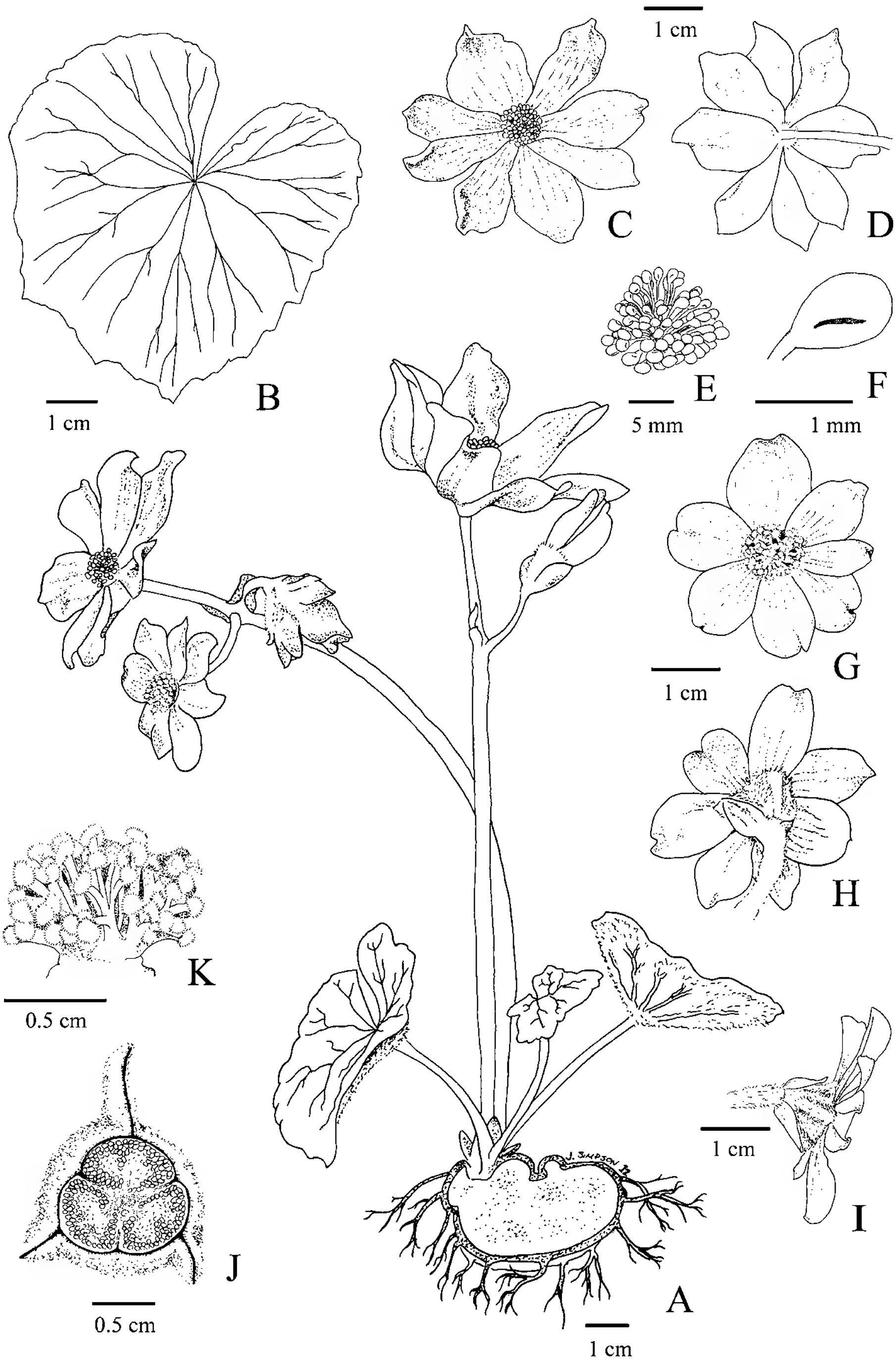


Figure 1. *Begonia marinae* Tebbitt. —A. Habit. —B. Leaf blade. —C. Male flower, front view. —D. Male flower, rear view. —E. Androecium. —F. Stamen. —G. Female flower, front view. —H. Female flower, rear view. —I. Female flower, side view. —J. Ovary cross-section. Style and stigma. —K. Style and stigma. Drawn by Johnathyn Simpson, from *Tebbitt 716* (USZ).

IUCN Red List category. *Begonia marinae* is assessed as of Least Concern (LC), according to IUCN criteria (2010).

Phenology. *Begonia marinae* was collected in flower from January to July.

Etymology. The specific epithet makes reference to Saint Marina the Monk (6th century) who from childhood to her time of death disguised herself as a monk so that she could live in a monastery. The female flowers of *Begonia* similarly mimic male flowers. *Begonia* are monoecious or dioecious, and most have female flowers with prominent bifid styles that mimic the androecium of the male flowers. This mimicry extends to both the shape and color of the styles, and since the female flowers do not provide rewards, this resemblance may deceive pollinators into visiting them (Schemske & Ågren, 1995; Schemske et al., 1996; Le Corff et al., 1998). The styles of this new species, like other members of the *B. octopetala* species group, are multifid, but are more highly dissected than other members of this group and as a result show a particularly close mimicry to the androecium.

Taxonomic notes. *Begonia marinae* is morphologically most similar to *B. pleiopetala*, typically sharing an orbicular to ovate-orbicular leaf blade with a dentate margin, as well as asymmetric inflorescences. The new species, however, differs in several respects. For example, the leaf blades of *B. marinae* are usually larger (3.5–16 cm long vs. 1.3–9 cm long in *B. pleiopetala*) and are prominently covered with white-tomentose hairs on their lower surfaces (vs. a sparse to moderate cover of pilose hairs or glabrous in *B. pleiopetala*). Similarly, *B. marinae* has tepals that are bright pink (vs. white or pale pink in *B. pleiopetala*). The tepals of *B. marinae* are also broader (in male tepals 1.3–2.2 cm wide vs. 0.15–0.8[–1.1] cm wide in *B. pleiopetala*). The two species typically also differ in tepal number, with *B. marinae* having (six) seven or eight tepals in male flowers and six to 11 tepals in female flowers (vs. usually eight to 10 tepals [as few as five in depauperate specimens] in male flowers and seven to nine tepals in female flowers in *B. pleiopetala*). Lastly, the ovaries of *B. marinae* have two prominent bracteoles at their base (while those of *B. pleiopetala* lack bracteoles), and the ovary body itself is larger (0.8–1 × 0.75–1.2 cm vs. 0.3–0.7 × 0.3–0.55 cm in *B. pleiopetala*). Color photographs of two collections of *B. marinae*, *Tebbitt 720* and *Tebbitt 758* (USZ), appear in Tebbitt (2012, 2013).

In Santa Cruz, *Begonia marinae* was observed growing alongside *B. krystofii* Halda, *B. micranthera* Griseb., *B. tominana* Golding, and an undescribed *Begonia* species, all of which belong to *Begonia* sect. *Eupetalum* but not to the *B. octopetala* species group. A single putative hybrid (*Tebbitt 717*, USZ) between *B. tominana* and *B. marinae* was observed at one of these sites. *Begonia marinae* did not appear to hybridize with the other three species found in this area, even though they were observed to all flower at the same time. In the eastern margin of the Tariquia Flora and Fauna National Reserve, the species commonly grows alongside *B. micranthera* but does not appear to hybridize with this species.

Paratypes. ARGENTINA. **Salta:** s. loc., *E. Petersen & J. P. Hjerting 1171* (C); Station Victoria, entre Abre de Peña Negra y Abra de San José, 7 Feb. 1953, *H. Sleumer 3815* (US). BOLIVIA. **Chuquisaca:** Zudañez, Redencion Pampa, ca. 3 km de la comunidad, sect. Ichuloma, 18°49′S, 64°34′W, 23 Apr. 2011, *J. Gutiérrez 1634* (HSB); Jaime Zudáñez, S de Icla, Cordillaria de Mandinga (Sombreros), 19°25′S, 64°41′S, 16 Jan. 2013, *M. C. Tebbitt 758* (USZ); Tomina, en la parte superior de un pequeño acantilado hierba a pocos metros de la carr., ca. 7 km por carretera de Tomina hacia Villa Serrano, 19°08′S, 64°24′S, 5 Jan. 2013, *M. C. Tebbitt 743* (USZ); Sud Cinti, Puca Pampa, ca. 7.5 km de Puseto ganadero, al SW, 20°46′S, 64°34′W, 2 Dec. 2004, *J. Gutierrez, H. Huaylla, A. Lliully, R. León, I. Guachalla & E. Portal 591* (HSB, MO). **La Paz:** Inquisivi, carabuco along rd. betw. Choquetanga & Carabuco Power Station & for 0.5 km N along E bank of Rio Miguillas from Carabuco Power Station, 1–2.5 km N of Choquetanga, 16°50′S, 67°19′W, 28 Jan. 1989, *M. Lewis 37044* (LPB, MO). **Santa Cruz:** Vallegrande, Routa del Ché betw. Vallegrande & Pucara, 18°35′S, 64°06′W, 11 Jan. 2012, *M. C. Tebbitt 720* (USZ); Vallegrande, Routa del Ché betw. Vallegrande & Pucara, 11 Jan. 2012, *M. C. Tebbitt 716* (MO, USZ). **Tarija:** Arce, Mpio. Padcaya, Reserva Nac. de Flora y Fauna Tariquía, 21°54′S, 64°33′W, 3 July 2005, *M. Serrano, J. Villalobos & A. Lliully 6085* (MO); Acre, entrado por el Rio Carbonejo, Exp. S. Incl. 30°, Bosque de Aliso, 3 Feb. 1988, *M. Liberman 2000* (US).

2. Begonia octopetala L'Hér., Stirp. Nov. [fasc. 4]: 101. 1788. *Begonia grandiflora* Knowles & Wescott, Fl. Cab. 1: 51, t. 25. 1837. *Huszia octopetala* (L'Hér.) Klotzsch, Monatsber, Königel. Preuss. Akad. Wiss. Berlin, 121. 1854. TYPE: Peru. Lima, *J. Dombey s.n.* (holotype, P).

Leaf blades ovate, or almost orbicular, or deltoid, 6–17 × 6.5–22 cm, abaxial blade surface sparsely to densely pubescent, hairs never forming a white reflective surface, blade margin usually shortly triangular-lobed, lobes to 2.5 cm deep. Male flowers with tepals 6 or 7 to 10, spreading, outer pair of tepals ovate or obovate, 1.2–3.2 × 0.5–2.7 cm, tepal margin entire, inner 5 to 8 tepals spatulate, 1.2–3.2 × 0.5–2.7 cm, tepal margin entire; anthers oblong to

oblong-obovate, connectives not projecting, slightly asymmetrically basifixed. Female flowers with bracteoles absent; tepals 6 or 7, spreading, tepal margin entire.

KEY TO *BEGONIA OCTOPETALA* INFRASPECIFIC TAXA

1a. Leaf blade ovate, or almost orbicular; male tepals 7 to 10; female tepals 6; fruit wing to 3.5 cm long; eastern Andes of Ecuador and Peru and coastal lomas of Peru .... 2a. *B. octopetala* subsp. *octopetala*

1b. Leaf blade deltoid; male tepals 6; female tepals 7; fruit wing to 4 cm long; eastern Andes of central Peru .... 2b. *B. octopetala* subsp. *ovatiformis*

2a. Begonia octopetala L'Hér. subsp. **octopetala**

Phenology. Throughout most of its distributional range, *Begonia octopetala* subsp. *octopetala* has been collected in flower from March to July, but in the lomas formations of northern Peru (Lima, La Libertad), it has been collected in flower from July to October and rarely into November.

Distribution and ecology. *Begonia octopetala* subsp. *octopetala* is a widespread and locally common taxon that occurs on the western side of the Andean mountains of Ecuador (Cotopaxi, Pastaza, Bolivar, Chimborazo, Cañar, Azuay, Loja) and northern Peru (Piura, Cajamarca, La Libertad, Ancash, Lima) at altitudes between 1800 and 3300 m. It occupies open or scrub-covered rocky slopes and pasture land and rocky montane forest, in both seasonally dry areas and in more mesic areas. *Begonia octopetala* subsp. *octopetala* also occurs in the lomas formations of northern Peru (La Libertad, Lima) at altitudes of 170–730 m. Here it grows on open or scrub-covered, west-facing slopes, often toward the crest of the hills, and is found in full sun or the shade of rocks or shrubs, usually in well-drained, humusy soils, and often in rock crevices.

2b. Begonia octopetala L'Hér. subsp. **ovatiformis** Irmsch., Bot. Jahrb. Syst. 76: 75. 1953. TYPE: Peru. Huacachi, estacion near Muña, 6500 ft., 20 May 1923, *J. F. Macbride 4143* (holotype, F; isotype, B).

Distribution and ecology. *Begonia octopetala* subsp. *ovatiformis* is known from a single collection made in central Peru (Huanuco), where it is found on moist rock ledges, and shaded rocky cliffs between 1800 and 1980 m.

Phenology. *Begonia octopetala* subsp. *ovatiformis* has been collected in flower in May.

3. Begonia pleiopetala A. DC., Ann. Sci. Nat., Bot., sér. 4, 11: 121. 1859. TYPE: Peru. Andibus, s.d., *J. McLean s.n.* (holotype, K [barcode] 000252037).

Begonia gracillima A. DC., Ann. Sci. Nat., Bot., sér. 4, 11: 120, 1859, syn. nov. TYPE: Bolivia. s. loc., 1839–1840, *C. Gay s.n.* (lectotype, designated here, P [barcode] 00482219, P photo at F; isolectotype, G-DC).

Begonia pusilla A. DC., Ann. Sci. Nat., Bot., sér. 4, 11: 120. 1859. TYPE: Bolivia. Prov. De Yungas, Dec. 1846, *H. A. Weddell 4215* (lectotype, designated here, G-DC, G-DC photo at F; isolectotype, P [barcode] 00482207, P photo at F).

Begonia tenuicaulis A. DC., Ann. Sci. Nat., Bot., sér. 4, 11: 120. 1859, syn. nov. TYPE: Bolivia. Prov. De Larecaja et Caupolican (vallées entre Tipoani et Apolobamba, May 1847, *H. A. Weddell 4592* (lectotype, designated here, P [barcode] 00482211, P photo at F; isolectotype, G-DC).

Begonia warburgiana Hieron., Bot. Jahrb. Syst. 21: 325. 1895. TYPE: Bolivia. Illimani, entre Pongo y Apacheta, 3800 m, 17 Dec. 1876, *A. Stübel 24b* (lectotype, designated here, B [barcode] 10 0186583; isolectotype, B [barcode] 10 0186583).

Acaulous herb, with a tuber-like rhizome; rhizome growing in a horizontal plane just below the surface of the substrate, to 5 cm long, 0.3–1 cm diam., unbranched; stipules persistent, membranous, triangular-ovate to ovate, 2.5–15 × 1–8 mm, apex acute, aristate, margin entire. Leaves 1 to 4, alternate, arising from apical portion of rhizome, basifixed; petiole ± oriented in same direction as main vein of blade, 1.5–18.5 cm, usually densely to moderately villous to tomentose in upper half and sparsely villous in lower half, occasionally sparsely villous along entire length; blades usually symmetric but occasionally asymmetric, ovate to orbicular, 1.3–9 × 1.5–11.5 cm, apex acute to obtuse, base cordate or obliquely cordate, lobes rounded, not overlapping, sinus 0.3–4 cm deep, margin with triangular to crenate teeth, teeth tipped with short hair, margin sometimes also lobulate, lobules 2–8 mm deep, adaxial blade surface green, usually with a moderate to dense cover of pilose hairs or occasionally glabrous, abaxial blade surface usually with a moderate to dense cover of pilose hairs along the main veins and elsewhere hairs absent or sparse, or occasionally glabrous throughout, veins palmate, 6 to 8. Inflorescences 1 to 3, axillary in apical portion of rhizome, erect, asymmetric, cymose, unbranched, bearing 2 to 5 flowers, with up to 3 male or 3 female flowers, proximalmost flower usually female; peduncle red, 3.5–30 cm, sparsely to densely villous,

sometimes gradually becoming almost glabrous in lower half; pedicels of male flowers red, 0.6–4.5 cm, sparsely to densely tomentose; pedicels of female flowers red, 0.4–3 cm, sparsely to densely tomentose; bracts persistent, ovate, 2–13 × 0.75–5 mm, apex acute, margin entire. Male flowers with the tepals spreading, usually 8 to 10 but as few as 5 (in depauperate plants in the southern part of the species' range, e.g., *Weddell 4215*), 4–19(–23) × 1.5–8(–11) mm, white to pink, outer surfaces of outermost tepals with wavy pilose hairs, which are moderate to dense at the bases and increasingly sparse toward apices, narrowly elliptic to narrowly obovate, subequal, apex obtuse, base usually tapering, occasionally rounded, margin entire; stamens 20 to 90, arranged on and around a raised receptacle or attached along the length of a 1–1.5 mm tall torus and also around base of torus; filaments 1.5–2 mm; anthers narrowly elliptic to oblong, 0.75–1.75 mm, dehiscing via lateral slits, connective usually shortly projecting to 0.25 mm, occasionally not projecting, symmetrically basifixed to filaments. Female flowers with bracteoles absent; tepals persisting in fruit, spreading, seven to nine, 3–14 × 1–6 mm, white to pink, otherwise similar to male flowers; ovary body broadly obovate to suborbicular, 3–7 × 3–5.5 mm, glabrous to pubescent, often with 1 wing on the dorsal edge and 2 angles, or 3-angled and wingless, when present, wing is ligulate-triangular, to 1 cm tall, front edge often truncate and slanted over styles or slightly concave and curved over styles, rear edge slightly convexly rounded, apex acute to somewhat obtuse; 3-locular, placentas axile, bifid, ovules arranged on both surfaces; styles three, 1.25–5 mm tall, shortly fused at base, multifid, branches erect, stigmatic papillae arranged in spiral bands along the branches. Fruiting peduncle to 30 cm; fruiting pedicel to 3.5 cm, subnutant; fruit a capsule, body broadly obovate to suborbicular, to 1.1 × 1 cm, glabrous to pubescent, 1-winged, wing triangular, to 1.5 cm tall, apex acute.

Distribution and ecology. *Begonia pleiopetala* is known to be widespread and locally common in Andean Peru (Piura, Huánuco, Huancavelica, Ayacucho, Apurimac, Cusco, Puno) and northern Bolivia (La Paz), usually between 2200 and 3750 m, but occasionally down to 1900 m. This species has been collected in humid places, usually next to sheltering rocks or boulders, in a variety of soils and in full sun or shade. It has been noted as often growing on open slopes, but is also found in thickets and on ancient rockwork.

It is interesting to note that *Begonia pleiopetala* has been collected at altitudes up to 3750 m in Bolivia, for example, at Lagunillas (La Paz; *Brooke 6162*), which is close to the upper elevational limit for the family. Within the Begoniaceae, only *B. veitchii* Hook. f. of Peru and *B. tafiensis* Lillo of Argentina, which have been recorded up to 3800 and 4000 m, respectively, occur at higher elevations.

IUCN Red List category. *Begonia pleiopetala* is assessed as Least Concern (LC), according to IUCN criteria (2010).

Phenology. Throughout most of its distributional range, *Begonia pleiopetala* has been collected in flower from December to May and rarely into early June. In the eastern Andes of Peru (Cusco, Puna) and on occasion in the neighboring part of La Paz, Bolivia (*Rusby 682*), flowering was noted from October to November.

Etymology. The specific epithet refers to the relatively numerous tepals of both the male and female flowers compared to those of most members of the genus, beyond the *Begonia octopetala* species group.

Taxonomic notes. *Begonia pleiopetala* is morphologically most similar to *B. octopetala*, as well as the two species newly described here. *Begonia pleiopetala* and *B. octopetala* may be readily distinguished from one another by the shape of their anthers. In *B. pleiopetala*, the anthers are symmetrically attached to the filament and are usually narrowly oblong with more or less projecting connectives. However, in larger plants from the northern part of the species' range (e.g., *A. Weberbauer 6026*) the connectives may not project. In *B. octopetala*, they are asymmetrically attached to the filament and are wider, oblong to oblong-obovate and always lack projecting connectives. *Begonia pleiopetala* is also consistently smaller in almost all of its vegetative and floral parts compared to *B. octopetala*, is often found at higher altitudes, and has a more southern and eastern distribution than *B. octopetala*.

Begonia pleiopetala shows a rough morphological cline from larger to smaller plants from north to south within its distributional range. Irmscher annotated the larger northernmost specimens of this species (all housed at F, e.g., *A. Weberbauer 6026*) as *B. pleiopetala* var. *occidentalis* nom. ined. but never published this name. Perhaps this was because size is the only difference and no clear-cut distinction could be made between northern and southern populations in the Peruvian Andes. The smallest specimen observed in the current study was the type of *B. pusilla*, while three other collections, which are almost as small and also unusual (but not unprece-

dented) in having both short hairs on the leaves and relatively fewer tepals, are the types of *B. tenuicaulis*, *B. gracillima*, and *B. warburgiana*. All four of these smaller collections are here considered synonymous with *B. pleiopetala* and fall within the quantitative variability for the taxon. Smith and Schubert (1941: 191) previously commented that the type of *B. gracillima* "may be only a depauperate form of *B. pleiopetala*."

In the original description of *Begonia gracillima* (de Candolle, 1859), a single collection, *Gay s.n.*, is cited and is, therefore, the type of this taxon. Specimens of this collection, mistakenly annotated by de Candolle as *B. gracilis* A. DC., are located both in G-DC and in P. In his original publication of the species, de Candolle (1859) did not include a herbarium locality for this collection but in a later publication (de Candolle, 1864) cited the specimen in P. Accordingly, the P specimen of *Gay s.n.* is here designated as the lectotype of *B. gracillima*, while the specimen at G-DC is the isolectotype.

In the original description of *Begonia pusilla*, two syntypes are cited, representing collections by Weddell and Bridges. Specimens of the Weddell collection, located at P and G-DC, and the Bridges collection, located at BM and CGE, are both annotated by de Candolle as *B. pusilla*. The G-DC specimen in addition uniquely bears a short handwritten description of the new species by de Candolle. The G-DC specimen of *Weddell 4215* is here accordingly designated as the lectotype of *B. pusilla*, while the specimen at P is the isolectotype.

In the original description of *Begonia tenuicaulis* (de Candolle, 1859), a single collection made by Weddell, is cited and is, therefore, the type of this taxon. Specimens of this collection are located both in G-DC and in P. In his original publication of the species, de Candolle (1859) did not include a herbarium locality for the Weddell specimen but in a later publication (de Candolle, 1864) cited the specimen in P. Accordingly the P specimen of *Weddell 4592* is here designated as the lectotype of *B. tenuicaulis*, while the specimen at G-DC is the isolectotype. A mounted photograph of the lectotype is located at F.

There are two sheets at B, with "*Begonia warburgiana* Hieron. nov. spec." annotated in hand similarly, which match the description of the type of this taxon as cited by Hieronymus (1896: 325). Both sheets are currently labeled as type and carry the same barcode, B 10 0186583. The botanical code (McNeill et al., 2012, Art. 8.2 and 8.3), however, states that a type should consist of a single specimen consisting of a single herbarium sheet, unless multiple sheets are labeled as being part of the same specimen. Since there is no indication that the two sheets are part of the same specimen, the sheet of *Stübel 24b* bearing a plastic envelope is designated here as the lectotype, while the second sheet bearing a white paper envelope is the isolectotype.

Additional specimens examined. BOLIVIA. s. loc., 1846, *T. Bridges s.n.* (BM, CGE). **La Paz:** Franz Tamayo, ANMI, Apolobamba, Keara Viejo, 14°42′S, 69°04′W, 14 Apr. 2006, *A. F. Fuentes et al. 9795* (MO); Franz Tamayo, ANMI, Apolobamba, Pelechuco camino rio abajo hacia Piara, 14°48′S, 69°02′W, 17 Apr. 2006, *A. F. Fuentes et al. 10020* (MO); Murillo, Valle del rio Zongo, 16°09′S, 68°07′W, 14 Apr. 1987, *J. C. Solomon 16487* (MO); Nor Yungas, 36 km NE of Puesto de Transito (La Paz) on rd. to Unduavi, below Rinconada, 16°20′S, 67°58′W, 22 Feb. 1980, *J. C. Solomon 5035* (MO); Sur Yungas, El Chaco, 2 Dec. 1920, *E. Asplund 1318* (S); Unduavi, 16 Dec. 1920, *E. Asplund 1808* (S); La Paz–Coroico rd., Km. 35, 11 Dec. 1980, *H. Balslev 1130* (NY); Murillo, Valle de Zongo, Ceja de la montaña, 12 Jan. 1980, *G. Beck 2753* (LPB, US); Murillo, Pongo, de la cumber 14 km, hacia Unduavi, 4 Mar. 1981, *G. Beck 4644* (US); Lagunillas, over mtn. range behind Choro in St. Elena Valley, 6 Mar. 1950, *W. M. A. Brooke 6162* (BM, F, NY, S, US); Unduavi, 12 Feb. 1907, *O. Buchtien 126* (NY); *O. Buchtien 653* (GH, US, W); *O. Buchtien 4056* (NY); Murillo, Kanton Zongo, Zongotal, Weide 33 km oberhalb des Straßendendes (in dieser Höhe kein Ackerbau), 23 Feb. 1980, *J. Krach 8704* (GH); Unduavi, Oct. 1885, *H. H. Rusby 682* (BM, F, GH, K, NY, US); Pongo, 17 Feb.–1 Mar. 1926, *G. H. Tate 273* (NY); Murillo, Zongo Valley, 7 Apr. 2002, *J. R. I. Wood et al. 18044* (K). PERU. s. loc., s.d., *J. Soukup 1226* (F). **Apurimac:** Abancay, 18.6 km from Abancay on rd. from Cuzco, 17 Apr. 1971, *J. G. Hawkes et al. 5214* (C [2]). **Ayacucho:** Cangallo, 2 km past Ocros on rd. to Ayacucho, 18 Apr. 1971, *J. G. Hawkes et al. 5231* (C [3]). **Cusco:** Urubamba, Wiñayhuaya a Puyupata, s.d., *C. Ochoa 4* (MO); Cusco, La Convención, Distr. Huayopata, San Luis, 13°04′S, 072°23′W, 22 Mar. 2003, *G. Calatayud, I. Huamantupa, E. Suclli, J. Farfán, A. Carazas & Y. Vizcardo 1319* (MO); La Convención, Distr. Huayopata, sector Canchayoc, 13°07′S, 72°20′W, 21 Nov. 2006, *L. Valenzuela et al. 8022* (MO); Urubamba, Distr. Machu Picchu, Wiñay Wayna, 13°13′S, 72°30′W, 21 Feb. 2003, *L. Valenzuela et al. 1472* (MO). **Huancavelica:** Tayacaja, Montepungo Rd., E of Surcubamba, 13 Jan. 1939, *H. E. Stork & O. B. Horton 10376* (F, K); Huancavelica, Yauli, 11 Mar. 1939, *H. E. Stork & O. B. Horton 10861* (F, K). **Huánuco:** Santa Lusia, Cani, Pueblo 7 mi. NE of Mito, 16–26 Apr. 1923, *J. F. Macbride 3393* (F); 15 mi. SE of Huánuco, 31 May–3 June 1922, *J. F. Macbride & W. Featherstone 2129* (F). **Piura:** Huancabamba, above Palambla, Apr. 1912, *A. Weberbauer 6026* (F [2], GH, US). **Puno:** Sandia, Limbani, 17 Nov. 1938, *C. Vargas 1317* (F, GH, MO); Sandia, under rocks & on walls on slopes & ancient terraces of Limbani, 20 Nov. 1938, *C. Vargas 9632* (F, GH, MO [2], S).

4. Begonia pseudopleiopetala Tebbitt, sp. nov. TYPE: Peru. Contumazá: ca. 20 km S of Contumazá, ca. 18 km above Cascas, 7°25′S, 78°25′W, 14 Apr. 1986, *M. O. Dillon, D. Dillon*

& *A. Sagástegui 4528* (holotype, F; isotypes, GB, MO, US). Figure 2.

Diagnosis. Related to *Begonia pleiopetala* A. DC., but differs by having acuminate leaf tips (vs. acute to obtuse), obovate anthers (vs. narrowly elliptic to oblong), female flowers with only five tepals (vs. seven to nine), and anther connectives never projecting beyond the thecae (vs. usually prominently projecting past the thecae).

Acaulous herb, with a tuber-like rhizome; rhizome growing in a ± horizontal plane, irregularly shaped, 0.8–1.3 cm long, ca. 0.5 cm in diam., unbranched; stipules persistent, membranous, ovate-triangular, 2–3 × 1.5–2 mm, apex acuminate, aristate, margin entire. Leaves 1 to 3, alternate, arising from apical portion of rhizome, basifixed; petioles oriented in same direction as main vein of blade, 3.5–10.7(–50) cm, sparsely to densely pubescent; blades symmetric, ovate, 2–3.6(–5) × 2.5–4.2(–6.5) cm, apex abruptly acuminate, base cordate, lobes equal, not overlapping, sinus 1–1.5 cm deep, margin denticulate to dentate, teeth 0.5–2 mm deep, glabrous or tipped with very short hairs, adaxial blade surface sparsely to densely pubescent, abaxial blade surface pubescent only along main veins, veins palmate, 5 to 6. Inflorescence solitary, axillary in apical portion of rhizome, erect, 2- to 5-flowered, asymmetric, cymose, with up to 3 female flowers and 2 male flowers, proximalmost flower female; peduncle 12–33(–65) cm, sparsely to densely pubescent; pedicels of male flowers 1.2–4 cm, pubescent, hairs often denser in distal half; pedicels of female flowers 0.7–3.2 cm, hairs as in male pedicels; bracts persistent, ovate or elliptic-ovate, 2.5–11 × 1.75–8 mm, apex acute, margin entire, outer surfaces pubescent, inner surfaces glabrous. Male flowers with the tepals spreading, 7 or 8, white or rose pink, obovate, spatulate, or elliptic, 1.3–1.9 × 0.5–1.1 cm, apex obtuse, base tapering, margin entire, outer surfaces sparsely to densely pubescent toward base; stamens ca. 100, attached along the length of a ca. 1 mm tall torus; filaments 1.5–3 mm; anthers obovate, ca. 1 mm, dehiscing via lateral slits, connectives not projecting, asymmetrically basifixed to filaments. Female flowers with bracteoles absent; tepals persisting in fruit, spreading, 5, white or rose pink, obovate or elliptic, 0.8–1.7 × 0.25–0.7 cm, apex obtuse, base tapering, margin entire, glabrous throughout or outer surfaces pubescent; ovary body elliptic, 3–8 × 2–7 mm, ovary body and wings sparsely to densely pubescent, unequally 3-winged, one wing much longer than other two, longest wing with a truncate front edge and rounded back edge, apex either obtuse or somewhat flattened and acute, 0.8–1.5 × 0.5–1.05 cm, two smaller wings almost absent to 0.3 × 1 cm, usually triangular, with a truncate front edge and a straight rear edge, rarely ligulate; 3-locular, placentas axile, bifid, ovules arranged on both surfaces; styles three, 4–6 mm tall, multfid, branches ± erect, stigmatic papillae in short spiraled bands at ends of style branches. Fruiting pedicels to 3.5 cm, subnutant; fruit a capsule, body obovate-elliptic, to 8 × 7 mm, glabrous or sparsely pubescent, longest wing to 1.7 × 1 cm, front edge of wing becoming slightly convex rounded, otherwise as in ovary, shorter wings as in ovary.

Distribution and ecology. *Begonia pseudopleiopetala* is apparently a narrow endemic since it is known from a few collections made in the vicinity of Contumazá, Peru (Cajamarca), at 2100–2500 m, and from a single collection made near Huancabamba, Peru (Piura), at 1300–1500 m. At both localities, plants were noted to grow in humid, montane forest. Fieldwork is, however, required to critically examine the distribution of this poorly known species.

IUCN Red List category. *Begonia pseudopleiopetala* is assessed as Data Deficient (DD), according to IUCN criteria (2010). More collections are required before this species can be further evaluated.

Phenology. The Cajamarca populations of *Begonia pseudopleiopetala* were collected in flower from April to June, while the single Piura collection was collected in flower in late March.

Etymology. The specific epithet refers to the similarities between this species and *Begonia pleiopetala*, a species with which it has been confused in the past.

Taxonomic notes. *Begonia pseudopleiopetala* is morphologically most similar to *B. pleiopetala*, typically having relatively small leaf blades and an asymmetric inflorescence. The new species differs by having acuminate leaf apices (vs. acute to obtuse in *B. pleiopetala*), obovate anthers (vs. narrowly elliptic to oblong in *B. pleiopetala*), female flowers with only five tepals (vs. seven to nine in *B. pleiopetala*), and by its anther connectives never projecting (vs. usually shortly projecting in *B. pleiopetala*). *Begonia pseudopleiopetala* also has a strikingly different flower to leaf ratio, with the flowers appearing relatively large compared to the species' small leaves. Where their distributions overlap, the two species grow at different altitudes, with *B. pseudopleiopetala* occurring at 1300–2500 m and *B. pleiopetala* at 2700–2800 m.

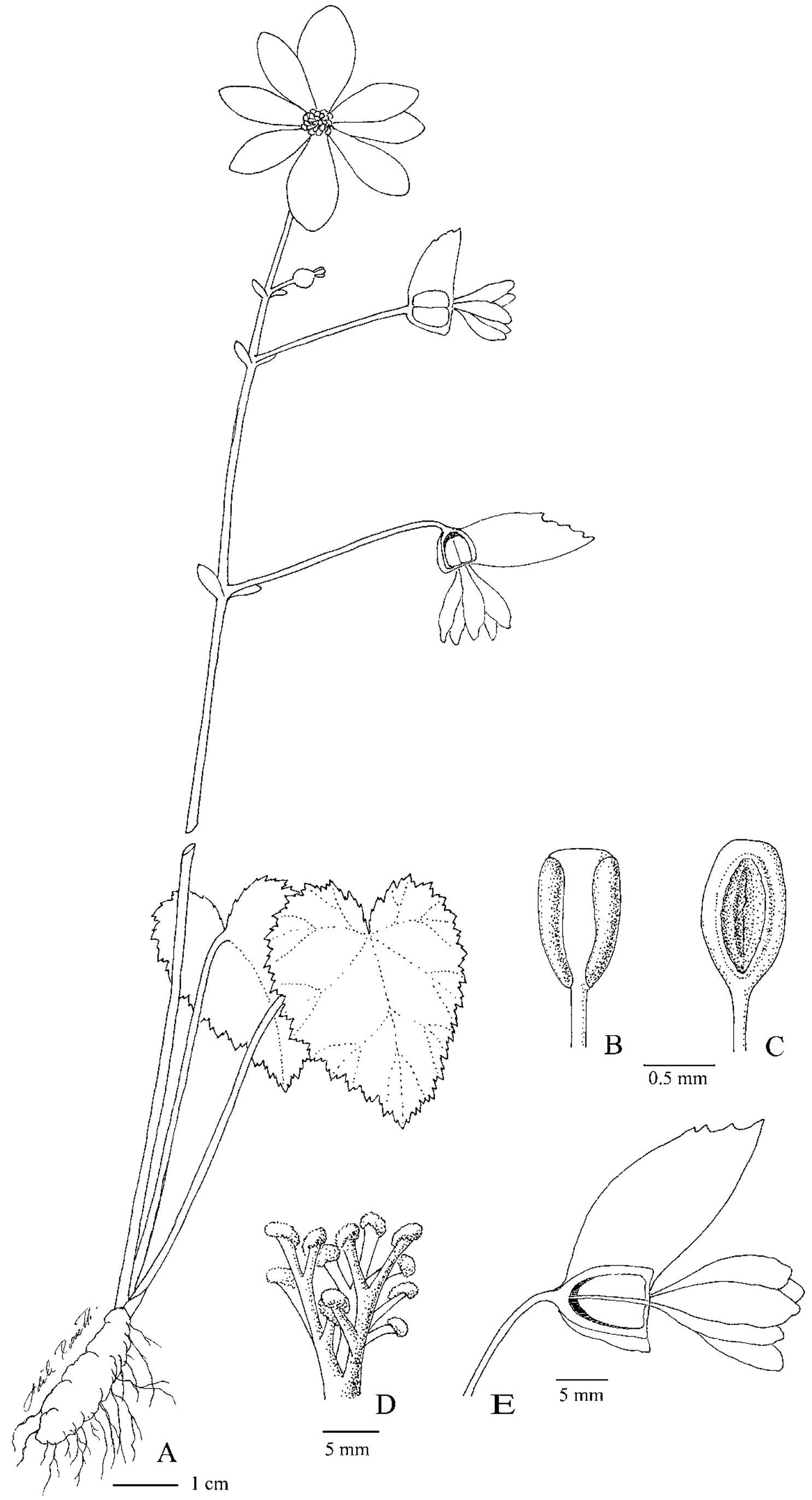


Figure 2. *Begonia pseudopleiopetala* Tebbitt. —A. Habit. —B. Stamen, front view. —C. Stamen, side view. —D. Styles and stigmas. —E. Fruit, side view. Drawn by Adèle Rossetti Morosini, from *A. Sagástegui et al. 15405* (F).

Based on the limited collections available, *Begonia pseudopleiopetala* appears to have a disjunct distribution. The species has been collected on four separate occasions near Contumazá in Peru's Cajamarca region, and once about 240 km to the north of this, near Huancabamba, in Peru's Piura region. Plants from these two areas differ slightly in their morphological features. The population from the

northernmost locality has rose-pink flowers (vs. white) and is more densely pubescent. I have, however, refrained from describing these apparently disjunct populations as infraspecific taxa until more collections are made. Additional fieldwork is required to clarify whether or not the species is truly disjunct since intermediate populations, if they occur, could conceivably span this morphological variation.

Paratypes. PERU. **Cajamarca:** Contumazá, Santiago Guzmango, 6 May 1965, *A. Sagastegui & M. Fukushima 5070* (HUT); Contumazá, Bosque Cachil, fragment of montane rainforest, 7°24′S, 78°46′W, 17 May 1993, *M. O. Dillon, A. Sagástegui, S. Leiva G., P. Lezama & P. Chuno 6506* (F); Contumazá, El Chorrillo (Cascas-Contumazá), 14 May 1994, *A. Sagástegui, S. Leiva & P. Lezama 15245* (US); Contumazá, Cascas-Contumazá, 19 May 1962, *A. Lopez, A. Sagastegui & I. Sanchez 3678* (HUT); Contumazá, Bosque Cachil, 16 June 1994, *A. Sagástegui 15405* (F, MO, NY). **Piura:** Huancabamba, above Canchaque, 22 Mar. 1948, *R. Ferreyra 3134* (GH, USM).

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Aristolochia longlinensis (Aristolochiaceae), a New Species from Western Guangxi, China

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ABSTRACT. *Aristolochia longlinensis* Yan Liu & L. Wu, a new species from western Guangxi, China, is described and illustrated here. It is morphologically most similar to *A. cucurbitoides* C. F. Liang, with which it has been taxonomically confused in the past. However, the new species can be easily distinguished from the latter by the trumpet shape of its flower limb (vs. cylindrical shape in *A. cucurbitoides*), ca. 1.8 cm in diameter at the mouth (vs. 2–3 mm), lobes widely deltoid (vs. lanceolate), ca. 5 × 20–25 mm (vs. 5–7 × 2–3 mm).

Key words: *Aristolochia*, Aristolochiaceae, China, Guangxi, IUCN Red List.

Aristolochia L., with approximately 400 species, is the largest genus in the family Aristolochiaceae (Huang et al., 2003, 2013; Xu et al., 2011; Wu et al., 2013). The genus has its main center of diversity in tropical America while the Hengduan mountainous region in China is the secondary one (Ma, 1989). Following the classifications of Duchartre (1854, 1864) and Schmidt (1935), the genus is divided into three subgenera on the basis of the morphological characters of the gynostemium, anthers, and capsule. *Aristolochia* subg. *Siphisia* (Raf.) Duch. is further divided into three sections, namely, *Aristolochia* sect. *Asterolytes* (Duch.) Duch., *Aristolochia* sect. *Hexodon* Duch., and *Aristolochia* sect. *Siphisia* (Raf.) Duch. *Aristolochia* subg. *Aristolochia* is similarly partitioned as *Aristolochia* sect. *Aristolochia*, *Aristolochia* sect. *Diplolobus* (Duch.) Duch., and *Aristolochia* sect. *Gymnolobus* (Duch.) Duch. The third subgenus is *Aristolochia* subg. *Pararistolochia* (Hutch. & Dalziel) O. C. Schmidt. The classifications of Duchartre (1854, 1864) and Schmidt (1935) have been broadly accepted (Ma, 1989), in contrast to other treatments by Klotzsch (1859) and Huber (1960, 1985), who divide the genus into several small genera. Ma (1989) has revised the classification scheme based on *Aristolochia* species from eastern and southern Asia, which corresponds with the taxonomic perspectives of Duchartre and Schmidt. Further, González (1999) asserts that inflorescence morphology is taxonomically relevant at the infrageneric level.

According to Huang et al. (2003), there are ca. 45 species of *Aristolochia* in China, of which ca. 33 are endemic to the country. The name *A. wuana* Zhen W. Liu & Y. F. Deng (Liu & Deng, 2009) was proposed to replace the superfluous name *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao, which was blocked by the earlier name *A. macrocarpa* Duch. This new name, however, does not appear in the recent treatment of *Aristolochia* in volume 5 of the *Flora of China* (Huang et al., 2003). Additional species include four new species of *Aristolochia*: two from Hainan Island, China (Xu et al., 2011), and two from Guangxi, China (Huang et al., 2013; Wu et al., 2013), which have been recently described and illustrated. Thus, to date, there are ca. 50 named species of *Aristolochia* in China.

In 1975, a novel species of *Aristolochia* was described as *A. cucurbitoides* C. F. Liang, based on a specimen collected from Tianlin County, Guangxi, China (Liang, 1975). However, the flower of the specimen was not fully developed, and therefore the flower was described as a calyx having three lobes that were lanceolate based on another specimen collected from Yangbi County, Yunnan, China (Cheng et al., 1988). During a study of *Aristolochia*, a striking new species morphologically similar to *A. cucurbitoides* was found and is described here. Its flowers are distinctive in both living and herbarium specimens, but its leaves have been confused with the latter species.



Figure 1. *Aristolochia longlinensis* Yan Liu & L. Wu.—A. Fertile habit.—B. Lateral view of flower.—C. Flower from front view. Photos taken of the paratype *Yan Liu L0753* (IBK) at the type locality in Longlin County.

Aristolochia longlinensis Yan Liu & L. Wu, sp. nov. TYPE: China. Guangxi: Longlin County, Longhuo Township, Diyan Village, 24°34′N, 105°35′E, 1 200 m, 7 July 1991, *H.-Q. Wen 00314* (holotype, IBK; isotype, PE). Figures 1, 2.

Haec species *Aristolochiae cucurbitoidi* C. F. Liang affinis, sed ab ea limbo calycis tubaeformi (vs. cylindraceo) ad orem ca. 1.8 cm diam. (vs. 2–3 mm), lobis calycis late deltoideis apice acutis ca. 5 × 20–25 mm (vs. lanceolatis apice acuminatis, 5–7 × 2–3 mm) differt.

Herbs twining; stems terete, sparsely yellow-brown pubescent. Petioles 2–8 cm, sparsely villous; leaf blades trullate-lanceolate, ovate-lanceolate, or lanceolate, 12–20 × 4–6.5 cm, papery, both blade surfaces sparsely pubescent or abaxially glabrescent; veins palmate, in 5 or 6 pairs from base; blade bases auriculate, with a sinus 1.5–2.5 cm deep, blade apex

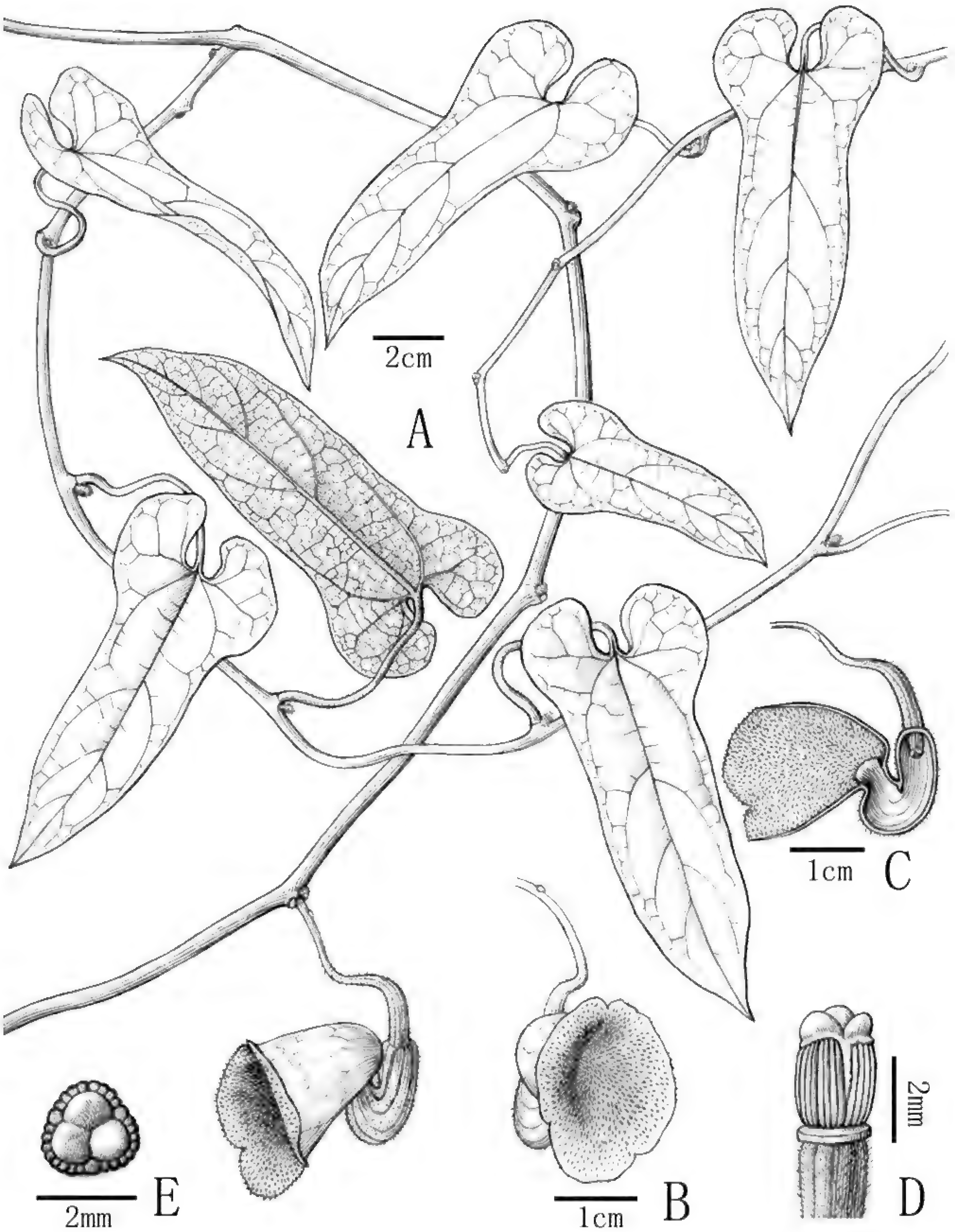


Figure 2. *Aristolochia longlinensis* Yan Liu & L. Wu.—A. Fertile habit.—B. Flower from front view.—C. Longitudinal section through the flower, showing the internal structure.—D. Anthers and gynostemium.—E. Gynostemium, view from above. Drawn by S. Q. He from the paratype *Yan Liu L0753* (IBK).

long acuminate. Flowers axillary, solitary; pedicels pendulous, 3–4.5 cm, sparsely pubescent; bracteoles ovate, ca. 3 × 2 mm, densely brown villous, inserted near the base of peduncle. Calyx yellowish green, limb purple; tube geniculately curved, externally yellowish green, internally purple, abaxially sparsely villous; basal portion of tube ca. 20 × 8 mm; limb trumpet-shaped, densely papillate on the inner surface, ca. 2 cm long, ca. 1.8 cm in diam. at the mouth, lobes 3, nearly equal, widely deltoid, apex acute, ca. 5 × 20–25 mm; anthers oblong, ca. 2 mm; gynostemium 3-lobed. Capsules not seen.

Habitat and distribution. *Aristolochia longlinensis* is known only from Longlin County in Guangxi Province. It was collected under open forest domi-

nated by Lauraceae, Fagaceae, Theaceae, and Betulaceae at altitudes from 1150 to 1250 m.

IUCN Red List category. At present, there are only seven known populations with fewer than five surviving individuals in each population. In addition, during our fieldwork, we found that farmland and eucalyptus forests were expanding in this area, which would of course result in deforestation and habitat loss for this species. This species is therefore assigned a status of Endangered [EN A1abcd + C2a(1)], according to IUCN Red List criteria (2001).

Phenology. *Aristolocia longlinensis* has been collected in flower from April to May. No fruiting specimens have been seen.

Etymology. The specific epithet is derived from the type locality of Longlin County, in Guangxi Province in southern China.

Discussion. The plant *Aristolochia longlinensis* has been collected previously, but the specimens were mistakenly identified as *A. cucurbitoides*, including a collection by Qi-Bin Huang from Longlin County in 1973 (Liang, 1975). The plant was not recognized as being different from *A. cucurbitoides* until the authors did fieldwork in Longlin County, photographing its flowers in 2003 (Fig. 2).

According to Ma's (1989) classification, *Aristolochia longlinensis* and *A. cucurbitoides* both belong to *Aristolochia* subg. *Siphisia* on the basis of the 3-lobed gynostemiums and oblong anthers that are adnate in pairs opposite the gynostemium lobes. However, *A. cucurbitoides* belongs to *Aristolochia* sect. *Pentodon* Klotzsch, based on the cylindric calyx limb, and *A. longlinensis* belongs to *Aristolochia* sect. *Nepenthesia* Klotzsch, based on the obliquely trumpet-shaped calyx limb.

Aristolochia longlinensis and *A. cucurbitoides* are most similar to one another. Shared characters include the twining, herbaceous stems that are not woody, the similar leaf shape, and the single-flowered inflorescences. However, *A. longlinensis* can be distinguished from *A. cucurbitoides* by its trumpet-shaped limb (vs. cylindrical), ca. 1.8 cm diameter at the mouth (vs. 2–3 mm), lobes widely deltoid and apex acute (vs. lanceolate and acuminate), ca. 5 × 20–25 mm (vs. 5–7 × 2–3 mm).

Paratypes. CHINA. **Guangxi:** Longlin County, Longhuo Township, under open forest, Sep. 1973, *Q.-B. Huang 10116* (IBK); 5 Apr. 2003, *Y. Liu L0753* (IBK).

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Plagiomnium wui (Mniaceae), a New Combination from Hubei, China

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Abstract. *Orthomnion wui* T. J. Kop. is transferred to *Plagiomnium* T. J. Kop. (Mniaceae) as *P. wui* (T. J. Kop.) Y. J. Yi & S. He, based on the presence of well-defined stereid cells in its costa, a key character distinguishing *Plagiomnium* from *Orthomnion* Wilson. Originally described in 2007 from Hubei, China, *O. wui* is closely related to *P. rostratum* (Schrad.) T. J. Kop. but differs from the latter by enlarged juxtacostal cells, the thin-walled, almost undifferentiated epidermal cells of the dorsal costa and non-mammillate laminal cells. An updated key to the species of *Plagiomnium* in China is provided.

Key words: Mniaceae, moss, *Orthomnion*, Plagiomniaceae, *Plagiomnium*.

Orthomnion Wilson (Mniaceae) is a moss genus primarily distributed in tropical and subtropical Asia. The genus, currently consisting of 11 species (Crosby et al., 2000), is characterized by entire or seldom bluntly serrate leaf margins that are usually narrowly or indistinctly bordered, costae that end well below the leaf apex, absence of the stereid cells in the costa, and erect capsules with a reduced peristome. Without sporophytes, sterile plants of *Orthomnion* are very similar to those of *Plagiomnium* T. J. Kop. Gametophytically, the presence of the stereid cells in the costa has been an important character used to separate the two genera (Koponen, 1980; Eddy, 1996; Li et al., 2007; Harris, 2008).

Eight species of *Orthomnion* have been reported from China (Li, 2006; Koponen, 2007; Li et al., 2007; Jia & He, 2013). In reviewing the Chinese species of the genus, we had an opportunity to examine the holotype and paratypes of *O. wui* T. J. Kop. deposited at MO. Our examination reveals that it has well-defined stereid cells in the dorsal costa (Fig. 1D, E). Indeed, in the illustrations of *O. wui* (Koponen, 2007: fig. 1J–K), there are two cross-sections of the costa that clearly show stereid cells. The presence of stereid cells in *O. wui* obviously does not fit the well-established generic concept of *Orthomnion* (Koponen, 1968, 1980; Eddy, 1996; Li, 2006; Li et al., 2007; Harris, 2008). Several other features of this species are atypical for *Orthomnion*: the leaf margin is distinctly bordered by multi-rowed linear cells with serrulate marginal teeth; the laminal cells are thin-walled, hardly porose, but with corner thickenings; and the costae end just below the apex or sometimes are percurrent in lower leaves (Fig. 2A, B). These characters, in combination with the presence of the costal stereid cells, place the species in *Plagiomnium*. In our opinion, *O. wui* is closely related to *P. rostratum* (Schrad.) T. J. Kop. in *Plagiomnium* sect. *Rostrata* (Kindb.) T. J. Kop. (Koponen, 1972). We therefore propose the following new combination.

Plagiomnium wui (T. J. Kop.) Y. J. Yi & S. He, comb. nov. Basionym: *Orthomnion wui* T. J. Kop., Ann. Bot. Fenn. 44: 376. 2007. TYPE: China. Hubei: Mt. Shennongjia, Song-luo-shan, Tong-cha-gou, on moist rock, 1000 m, June–July 1976, *P. C. Wu 282* (holotype, MO-2846750; isotype, PE). Figures 1, 2.

Gametophytic plants medium-sized, yellowish brown when old, in loose tufts. Primary stems (stolons) and infertile stems prostrate, tomentose, ≤ 5 cm long, sparsely foliate; fertile stems erect, ≤ ca. 2 cm high, radiculose below; in cross-section a central strand present. Leaves crisped when dry, spreading when moist; stolon leaves oblong to ovate or elliptic, 4–4.8 × 2.2–2.5 mm, obtusely apiculate; lower fertile stem leaves similar to stolon leaves, becoming elongate obovate to oblong ligulate toward apex; all leaves not decurrent at the base; margins bordered by 3 or 4(5) rows of elongate cells at leaf base, by 1 or 2(3) at the apex, bluntly serrate; costa ending slightly below the apex to percurrent, costal cross-section with 2 or 3 layers of thick-walled cells on ventral costa, with stereid cells in dorsal costa; laminal cells ± similar, elongate hexagonal to

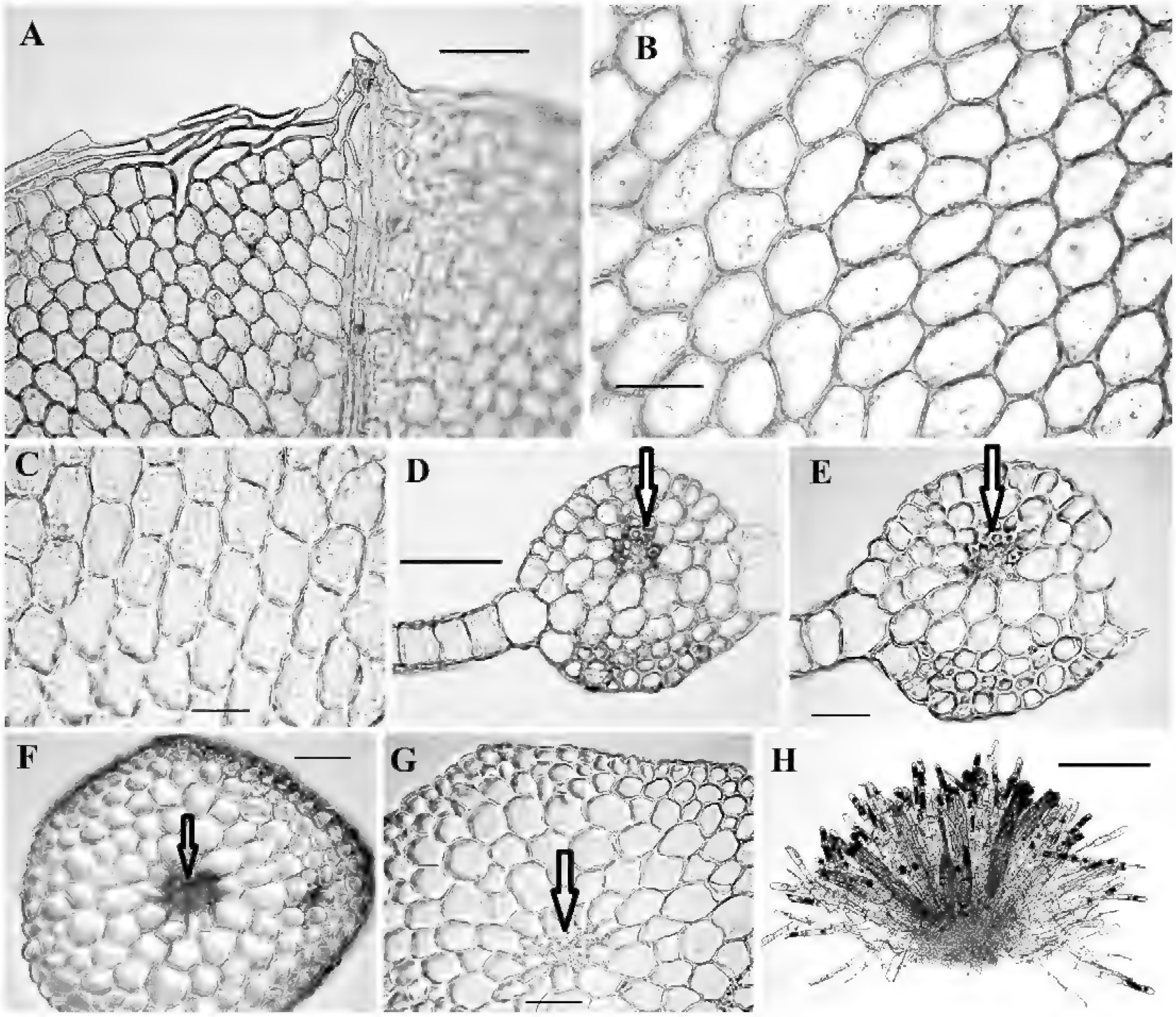


Figure 1. *Plagiomnium wui* (T. J. Kop.) Y. J. Yi & S. He. —A. Apical laminal cells. —B. Median laminal cells. —C. Basal laminal cells. —D, E. Cross-sections of leaf costa showing stereid cells pointed by arrows. —F, G. Cross-sections of stem with a central strand pointed by an arrow. —H. Antherida and archegonia mixed with paraphyses. Scale bars = 100 μm (A, D, G); bars = 50 μm (B, C, E, F); bar = 0.5 mm (H). A–H, prepared from the holotype *P. C. Wu 282* (MO).

rounded quadrate, 40–63 × 20–40 μm, median and basal juxtacostal cells somewhat larger than apical and basal cells, thin-walled, hardly porose, with distinct corner thickenings. Synoecious. Archegonia and antheridia mixed with abundant colorless paraphyses. Sporophytes unknown.

Distribution and habitat. *Plagiomnium wui* is known only from the type locality in Hubei Province of China, growing on moist rocks or on bases of trees.

Discussion. *Plagiomnium wui* is similar to *P. rostratum* in sharing numerous aspects of morphology, including synoecious sexuality, multi-rowed leaf borders, and non-projecting, 1-celled marginal teeth that are sometimes indistinct. *Plagiomnium wui* differs from *P. rostratum* in juxtacostal cells that are distinctly larger than adjacent laminal cells, epidermal cells of the dorsal costa that are thin-walled, not much smaller than the inner cells, and laminal cells that are never mammillate. In contrast, in *P. rostratum* juxtacostal cells are not larger than adjacent laminal cells; epidermal cells of the dorsal costa are thick-walled and much smaller than the inner cells; and laminal cells are slightly mammillate (Koponen, 1972).

In general, species of *Orthomnion* have erect capsules with reduced peristomes, whereas those of *Plagiomnium* have horizontal to pendulous capsules with well-developed peristomes. Gametophytically, *Orthomnion* differs from *Plagiomnium* primarily by the absence of a stereid band in the costa (Koponen, 1980; Eddy, 1996; Harris 2008). As Eddy (1996: 195) points out: "Non-fruiting plants of *Orthomnion* are difficult to distinguish from those of *Plagiomnium*, but doubtful sterile plants, however, can be separated on costal anatomy, since the costa of

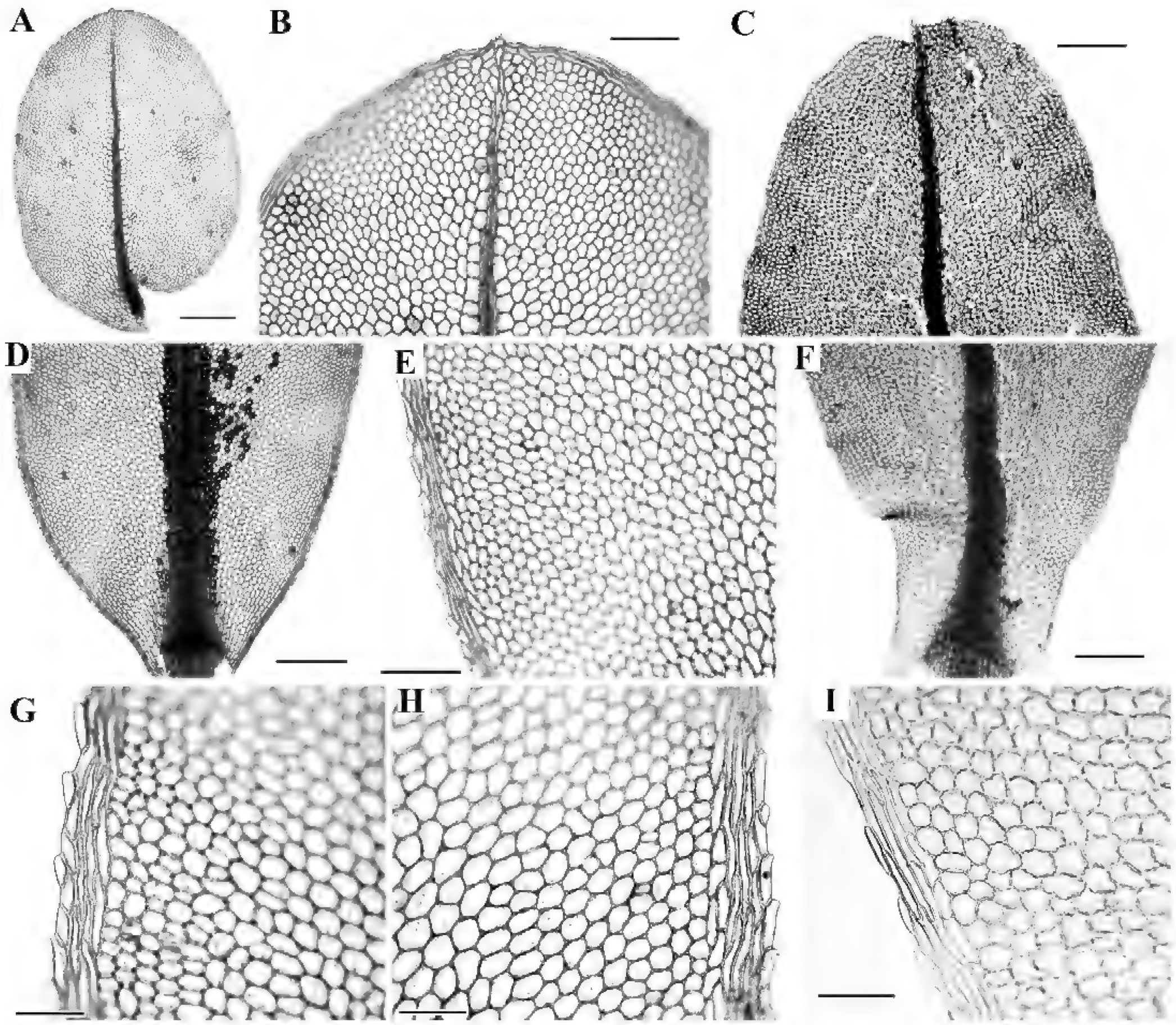


Figure 2. *Plagiomnium wui* (T. J. Kop.) Y. J. Yi & S. He. —A. Stolon leaf. —B. Apex of stolon leaf. —C. Apex of fertile stem leaf. —D. Base of stolon leaf. —E. Median part of stolon leaf. —F. Base of fertile stem leaf. —G, H. Stolon leaf margins at middle. —I. Stolon leaf margin at base. Scale bars = 0.5 mm (A, C, D, F); bars = 200 μm (B, E); bars = 100 μm (G–I). A–I, prepared from the holotype *P. C. Wu 282* (MO).

Plagiomnium has a distinct stereid band which is lacking in *Orthomnion*." In our view, the stereids in the costa are the only useful character that can be used to separate *Orthomnion* (without stereids) from *Plagiomnium* (with stereids). In a study of the genus *Orthomnion*, Koponen (1980: 38) also indicates: "The sterile plants of *Plagiomnium* sect. *Rostrata* with entire leaves may be difficult to differentiate from sterile *Orthomnion*. The only character always separating *Orthomnion* is the absence of the stereids of the costa." Using the absence of stereid cells in the costa to define the genus *Orthomnion* held up very well until *O. wui* and *O. yunnanense* T. J. Kop., X. J. Li & M. Zang (both with stereids in the costa and serrulate leaf margins) were placed into the genus (Koponen et al., 1982; Koponen, 2007). The importance of the costal stereid cells in the taxonomic placement of *Orthomnion* species can be seen in the treatment of *O. handelii* (Broth.) T. J. Kop. (Koponen, 1980). The latter does not have stereids in the costa but has horizontal capsules with a well-developed peristome (a *Plagiomnium*-like sporophyte). Clearly, the character of stereid cells outweighs sporophytic features in this instance, which could be interpreted that even a species with *Plagiomnium*-type sporophytes can occur in *Orthomnion*, while a species that lacks stereid cells in the costa cannot be placed in *Plagiomnium*. If the stereid cells in the costa were not considered as a distinguishing character, the generic distinction between *Orthomnion* and *Plagiomnium* would collapse because there are no other unique characters and there are exceptions for other potentially useful diagnostic characters within the two genera. Consequently, among several characters

separating *Orthomnion* from *Plagiomnium* (i.e., porose cell walls, cell corner thickenings, leaf sequence, and even sporophytic features), the stereid cells have become the only key character, in our opinion, that can be used in the separation of the two genera. The present study of *O. wui* has validated this concept, and we believe that future study of *O. yunnanense* will affirm this hypothesis/assertion. A recent molecular study by Harris (2008) indicated that the genus *Orthomnion* is well nested within *Plagiomnium*. The previous sectional classification of *Plagiomnium* (Koponen, 1968) is not supported by molecular phylogenies since all of the sections are paraphyletic. *Plagiomnium* sect. *Rostrata* would be monophyletic if *Orthomnion* was included (Harris, 2008). This implies that there is also a molecular basis for placing *O. wui* in the genus *Plagiomnium*.

Seventeen species of *Plagiomnium* were treated in the Chinese moss floras and in recent literature (Li, 2006; Li et al., 2007; Jia & He, 2013). Among these, *P. vesicatum* (Besch.) T. J. Kop. has been excluded from China due to the absence of any voucher specimens (Koponen, 1981; Koponen & Lou, 1982). The Chinese specimens of *P. elimbatum* (M. Fleisch.) T. J. Kop. have not been verified by the recently published flora (Li et al., 2007). *Plagiomnium venustum* (Mitt.) T. J. Kop. is essentially a species of western North America, and its occurrence in China is doubtful. With the addition of *P. wui*, 15 species of *Plagiomnium* are confirmed for China based on the present study.

Key to the Species of *Plagiomnium* in China

Note: This key should work for both stoloniferous and fertile stem leaves.

1a. Marginal teeth often short and blunt, sometimes indistinct or absent; leaf borders usually colored; opercula rostrate 2
1b. Marginal teeth often long and sharp, sometimes multi-celled; leaf borders often not colored; opercula not rostrate 7
2a. Leaves not decurrent 3
2b. Leaves decurrent 5
3a. Dioicous; leaf margins often bordered by 1 to 4 rows of ± broadly rectangular cells or by 1 or 2 rows of linear cells in stolon leaves; laminal cells 60–120 × 40–60 μm ..... *P. succulentum* (Mitt.) T. J. Kop.
3b. Synoecious; leaf margins always bordered by 3 to 5 rows of linear cells in all leaves; laminal cells 30–60 × 20–40 μm 4
4a. Juxtacostal cells not larger than adjacent cells; epidermal cells of the dorsal costa thick-walled, much smaller than inner cells; laminal cells somewhat mammillate ..... *P. rostratum* (Schrad.) T. J. Kop.
4b. Juxtacostal cells larger than adjacent cells; epidermal cells of the dorsal costa thin-walled, not particularly smaller than inner cells; laminal cells not mammillate ..... *P. wui* (T. J. Kop.) Y. J. Yi & S. He
5a. Leaves elliptic, plane; juxtacostal cells not larger than adjacent laminal cells ..... *P. integrum* (Bosch & Sande Lac.) T. J. Kop.
5b. Leaves linear to oblong or narrowly ligulate, often undulate; juxtacostal cells clearly larger than adjacent laminal cells 6
6a. Dioicous; laminal cells 12–25 × 10–20 μm ..... *P. maximoviczii* (Lindb.) T. J. Kop.
6b. Synoecious; laminal cells 15–40 × 10–25 μm ..... *P. rhynchophorum* (Harv.) T. J. Kop.
7a. Leaves obovate to elongate obovate; margins serrate only to the middle 8
7b. Leaves elliptic to elongate oblong; margins serrate nearly to the base 11
8a. Plants to 6(–10) cm tall; leaf marginal teeth sharp and large, sometimes consisting of 2(3) cells; laminal cells hexagonal to elongate-hexagonal, to 50(–60) μm long 9
8b. Plants often shorter than 3.5 cm tall; leaf marginal teeth always single-toothed; laminal cells isodiametric to rounded hexagonal, to ca. 35 μm in diameter 10
9a. Leaves shiny; costa percurrent to shortly excurrent; laminal cells not thickened at the corners; synoecious ..... *P. drummondii* (Bruch & Schimp.) T. J. Kop.
9b. Leaves dull; costa ending below leaf apex; laminal cells slightly thickened at the corners; dioicous ..... *P. japonicum* (Lindb.) T. J. Kop.
10a. Dioicous; leaves elongate-obovate; laminal cells isodiametric, not at all thickened at the corners, usually 20(–25) μm wide ..... *P. acutum* (Lindb.) T. J. Kop.
10b. Synoecious; leaves shortly obovate; laminal cells irregularly rounded hexagonal, slightly thickened at the corners, usually to 30(–35) μm wide ..... *P. cuspidatum* (Hedw.) T. J. Kop.
11a. Leaves narrowly oblong, often undulate; plagiotropic stolons not common 12
11b. Leaves broadly elliptic, often plane; plagiotropic stolons common 13
12a. Stems often with subapical branchlets; leaf apices acute; costa percurrent ..... *P. arbusculum* (Müll. Hal.) T. J. Kop.
12b. Stems scarcely with subapical branchlets; leaf apices rounded apiculate to mucronate; costa ending below leaf apex to percurrent ..... *P. confertidens* (Lindb. & Arnell) T. J. Kop.
13a. Dioicous; leaves not decurrent at the base; margins bordered by 4 to 8 rows of linear cells; marginal teeth always formed by a single cell ..... *P. ellipticum* (Brid.) T. J. Kop.
13b. Synoecious or dioicous; leaves decurrent at the base; margins bordered by 2 to 4 rows of linear cells; marginal teeth formed by 1 to 3(4) cells 14
14a. Synoecious; leaf apices acute; marginal teeth short, formed by 1 or 2 cells; laminal cells isodiametric to slightly elongate; cell walls not or indistinctly porose ..... *P. medium* (Bruch & Schimp.) T. J. Kop.
14b. Dioicous; leaf apices obtusely mucronate; marginal teeth long, sharp, formed by 1 to 3(4) cells; laminal cells elongate, twice as long as wide; cell walls clearly porose ..... *P. tezukae* (Sakurai) T. J. Kop.

Selected specimens examined (Plagiomnium rostratum). CHINA. **Hubei:** Mt. Shennongjia, Song-luo-shan, Tong-cha-gou, on moist rock, *P. C. Wu 81* (paratypes, MO-2846780, PE); Song-bo-ping, on base of tree, *P. C. Wu 135* (paratypes, MO-2846669, PE). **Yunnan:** Yangbi Co., *Redfearn et al. 418* (MO). JAPAN. **Kiushiu:** Kumamoto, *Mayebara 116* (MO). KAZAKHSTAN. **Alma-Ata:** Kazachka Gorge & River, *Allen 10691* (MO). RUSSIA. **Karachaevo-Cherkessian Republic:** Teberda Nature Reserve, *Ignatov & Ignatov 135* (MO).

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